THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XLII.—No. 2. Whole No. 614. | NEW YORK, FRIDAY, JANUARY 16, 1885. | $3 PER ANNUM IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. JOS. R. THOMAS, C.E., Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Published on the 2d and 16th of each month, at No. 42 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $3.50 (15 shillings—18 francs). All payments to be made in advance. Single copies, 15 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Books.—We will mail, post-paid, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. No books will be sent C. O. D.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—

The Gas Meter as a Vexatious Problem..... 29

Preparing and Applying a Coating of Gas Tar..... 30

Bids for Public Lighting in Brooklyn, N. Y..... 30

Suggestions for Reflection when in Thoughtful Mood—by Jos. R. Thomas, C. E..... 31

On the Use of Coal Gas—By H. Dixon, M. A..... 33

Gas Heat for Mechanical Purposes—By T. J. C..... 36

Coal Tar Colors..... 37

Oil and Gas Wells of Pennsylvania..... 38

Condensing Sulphuric Acid Gas..... 39

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 39

Yonkers (N. Y.) Gas Light Company Reduces Price of Gas—An Interesting Note from East Chester Company, of Mt. Vernon, N. Y.—Another Victim—Coke Fuel Consumption and Railroads—A Novel Way of Catching a Thief—Cheaper Gas for Topeka, Kan.—Electric Light Plant Injured by Lightning Strokes at Houston, Texas—A Trifling Difference in the Figures—Personal—Another Mysterious Pilgrimage Case, with the Reason Therefor—The Gate City Gas Company Increases the Atlanta (Ga.) Death Roll—An Explosion of Gas at North Adams, Mass.

A New York Victim..... 41

This One a Suicide..... 41

The Plumber Once More..... 41

Gas-Heated Assaying Furnace..... 41

Contract Awarded..... 41

The Market for Gas Securities..... 41

THE GAS METER AS A VEXATIOUS PROBLEM.

Of all the long string of reasons, according to the most usually accepted and indeed now universally put forward theories of the gas consumer as to why the managers of gas companies should be rated as but little, if any, removed from classification with ordinary road agents (often called highwaymen), none other seems to be so thoroughly convincing than the oft repeated fables respecting the gas meter. Mr. B. is perfectly willing to solemnly asseverate that upon the return of himself and family from their summer vacation (they were gone three months), they found a large gas bill awaiting quietly for settlement; and Mr. B. does not rest his case there. He is just as bold in his assertion that the house was closed up tight during the whole period; but in the next breath, as going to show his entire and positive fairness in the matter, he qualifies the absolute "tightness" by excepting the kitchen and one of the servant's bedrooms from the total. He was obliged to leave one domestic behind in order that the household goods might be watched over by vigilant eyes; but still and all he is perfectly certain that that gas bill represents at least five times the quantity of gas that could have been by any possibility consumed in the interregnum of the summer hegira. Then does the full measure of his wrath burst forth; and it is in truth hard to say which receives the most copious share of wordy castigation—the company or its meter. Indeed it matters but little so far as either of the culprits are concerned, as the interests of the two are so intimately connected that it is a case of Master or Tray. Before the softening influence of time has dulled the edges of his passion, the portly or slender (as the case may be), but equally indignant Mr. B. hies him away to the palatial marble halls of the oppressor, and all aglow with his earnestness of purpose, and anxiety for "a chance at 'em," he confronts the pampered cashier with an ominous frown, throws down the bill (still the stolid account awaits settlement), and then is his opportunity. The poor financial agent of a "bloated and grinding monopoly" hangs down his head, or else indulges in as vacuous an expression of countenance as he can command. He adopts neither line of conduct owing to shame or lack of courage on the one hand, or want of intelligence on the other. No; he has been through many such scenes before, and their frequent repetition has taught him the diplomacy, nay, necessity, of allowing "Nature take its course." When the first onslaught is over—the duration of which always depends much upon the physical and vocal condition of the disgruntled—a series of questions and answers are proceeded with. The vacuous look has departed from the cashier, and his head has resumed its normal poise. He asks the irate consumer whether the housekeeper in charge of the citadel has been catechised as to how much company she entertained in the kitchen during the absence of her employer, etc., and he is perfectly certain beforehand what the answer thereto is to be. Mr. B. did not put any of these questions to his faithful domestic, who had been employed by his family for a stated number of years (never less than seven), and was a most trustworthy, careful, economical person. Indeed it was solely on account of her superior qualifications in this regard that she was chosen to guard the home possessions, etc. When the wearisome cross examination draws to a close, the head of the household is satisfied, to a certain extent, that he has sufficiently asserted his knowledge of the rascality of the company, the duplicity of the meter, and other minor details going to make up the aggregate of the gross and unwarranted deception which has made him a martyr. Usually he ends by paying the bill, and goes off shaking his head as an evidence of the firm determination possessing his soul to

return to more primitive methods of artificial illumination. Sometimes he retires himself to the quiet of his library, and indites a letter to his favorite newspaper, in which he most pathetically portrays the evils suffered by him in particular, and his fellow consumers in general. It is to the letter-writing class of the disgruntled that the Annanias-like character of the meter is most painfully apparent; and it is upon this theme that his pen most loves to dilate.

Before leaving people of Mr. B.'s classification we would like to put upon record a case which may possibly be worthy of mention here, as it came under the personal observation of the writer. Some years ago, in a town not so very far from New York city as to require an extended journey to reach it, there resided a gas consumer who was never known to pay a gas bill without previously disputing its authenticity as to correct rating of charged consumption. The party was also, as may readily be inferred, a pronounced enemy to the gas meter, and never lost an opportunity of making strong avowal of his lack of confidence therein. The particular instrument registering his supply was a little more closely looked after than the general run of meters in the company's district, and so its accuracy was well known as a fixed fact. The consumer was a liberal user of gas, which might be accounted for from the important fact that he was the possessor of quite an interesting and a numerically strong body of daughters. During the first week in a certain month of June he determined to visit Europe, with his entire flock as a body guard. The house was to be closed during his absence to all intents and purposes, *except* that one female servant was to remain on duty to keep things in order; and the domestic received minute instructions as to how she was to act in regard to lighting arrangements. She *might* use the bracket burner in her bedroom, but a kerosene lamp was considered sufficient for all other illuminating requirements, in kitchen, etc. Our prudent man (the keeping of a servant in his employment during his absence was proof that ordinarily he was liberal enough) informed the officers of the gas company of his intended trip, and told them, inasmuch as he should not remain away over three months, and that as gas was only to be used after the manner indicated, it would hardly be necessary to send an inspector to take the meter until such time as the family returned. They made the trip, and returned in good order after an absence of just 92 days. The first thing done was to grant the servant who had so nobly guarded the homestead permission to visit some relatives, her leave of absence covering a week's time. While she was away the inspector called, read the meter, and turned his reading into the office. A change had been made in the bookkeeping department of the company, and the man who entered up the account handed the bill in due form to the collector. The latter called at the premises in question and inquired for paterfamilias; the gentleman was not at home, and the account was left with a domestic for transmission to the proper source. Materfamilias never deigned to look at it, but placed it in its appropriate pigeonhole. When the parental authority arrived back from his "outing," he in due course of time seated himself before his desk, and about the first thing to attract his attention was a pink-colored slip whose prior appearances had often been the signal for contention. He probably chuckled inwardly when he thought how small that quarter's gas bill must be; and how speedily that chuckle must have altered its nature when he found upon the harmless paper, spread out in bold relief, the figures $18.50! Now was the time for action, and here was the opportunity for showing up the meter, to say nothing of convicting the gas company. That citizen made haste to the cashier, and demanded an explanation. The offended consumer vouched for the faithfulness of his servant; the inspector was examined—he verified the meter reading; and the unfortunate meter was then tested. The test proved its accuracy, and further developments awaited the return of the domestic. When she reported for duty her employer immediately cross-examined her, and she averred she had followed his instructions in the matter of lighting. Then the "great defrauded" calmly awaited the advent of the gas company's superintendent; his cross-examination finally elicited from the recreant maid that, acting upon the advice of her "company" (she had the luck to ensnare a plumber) she had been induced to employ a small gas cooker whereupon to prepare her food during the hot summer time. Her faithful swain had procured the cooker and agreed to take it away before her employer returned. He kept his bargain; but the mystery of the whole thing was to satisfactorily explain why both of the parties should fail to remember that the meter was constantly piling up evidence to convict them.

We are disposed to believe that gas managers, as a rule, are most anxious to conciliate their customers, and are fast becoming adepts in the art of smoothing over the rough places. Prevention rather than cure of the quoted evil is surely the most efficient means of eradicating it, although it is quite certain that the constitutional grumbler will, to some extent, live in the future; but a victory will have been gained if his gruesome shadow be assisted to "grow less." The papers presented by Messrs. Nettleton and McMillin, to the last assembly of the American Gas Light Association (See Vol. XLI., Dec. 16, '84), are important inasmuch as they go to show the generally widespread attention now being directed to the importance of the regular periodical inspection of consumers' meters. Outside of the value of such inspection to a gas company in procuring intimate knowledge as to the life and working of each particular instrument, there is the further gain that a particularly obstreperous specimen of the consumer may at any time be confronted with this record to his utter confutation. It needs no argument here to show the fairness of the meter as a recording medium between the seller and consumer of gas—the average of the published figures in tests of government inspectors sufficiently prove the question. Right here we would say that Mr. Pearson, of Toronto, in his contribution to the discussion that followed the reading of the above-mentioned papers, put the case in the proper light when he said that gas managers in every State in the Union should not only be in favor of Government Inspection laws, but should give such statute formations absolute encouragement to become existent in sections where they were not already established. We believe that most of our States have already framed fair meter inspection enactments, and it is hoped the few remaining ones will follow the lead of the others. While we cannot agree with Mr. Monks, of the South Boston Gas Light Company (see discussion in volume above noted), as to the poor policy of making the inspection at the end of every three years, and do thoroughly coincide with Mr. Nettleton, as to his views on the subject, we heartily commend his plan of the glass encased or skeleton show meter, and applaud his selection of the place wherein to exhibit it. The smallest company in the country could with great profit to itself imitate his practice in this respect, and so stifle many a complaint ere it had rightly been emitted by the utterer. Forbearance, conciliation and proof tests are the potions most likely to still the spasms which so frequently agitate the average gas consumer when descanting upon his favorite theme—the rascally, lying meter.

Preparing and Applying a Coating of Gas Tar.

There are many localities in this country where the preservation of common external woodwork, such as fence posts, well covers, grain cribs, etc., from the ravages of moisture, and frequent extremely variable changes in temperature, becomes somewhat in the nature of a vexatious, not to say expensive problem. It is far from being a new suggestion to call attention to the efficacy of ordinary coal gas tar in the painting of such wooden surfaces, for the practice is certainly ancient enough to convince the reader that its use is not recommended on the score of novelty. Complaints have frequently been made that gas tar applications do not possess the virtues claimed; still such complaints are much more than offset by abundant testimonials to the contrary coming from experimenters who have made careful practical trials of the matter. The sort of coal carbonized has, of course, a most important bearing on the constituents of the tar product; but it may be safely assumed that a coal carrying a not abnormally high percentage of sulphur impurity will yield a tar that is in all respects fitted to the work of arresting the undue progress of decay in the sorts of rough woodwork mentioned above.

A method of preparing the tar for this system of painting, much in vogue in certain parts of Europe, is the following: An iron kettle capable of holding three gallons of tar is set over a slow fire, and the contents allowed to simmer for about an hour. After the simmering process has occupied the allotted time, add a handful of quicklime and stir it well in. Remove from fire, and add, say, a quart of benzine or naphtha—or a portion just sufficient to make the finished mixture run easily from the end of an old paint brush. The "paint" is then ready for use, and should be applied while quite hot. The best results will follow when the woodwork operated upon is in a thoroughly dry state.

Bids for Public Lighting in Brooklyn, N. Y.

The following are the various bids submitted by the gas companies of the city of Brooklyn for the public lighting of that place during 1885:

	Street Lamps.	Public Buildings.
Brooklyn Gas Light Company, each per annum	$19.80	$1.50 per M.
Williamsburgh " " " "	21.75	1.75 "
Peoples " " " "	22.00	1.75 "
Metropolitan " " " "	22.00	1.75 "
Nassau " " " "	22.00	1.75 "
Citizens " " " "	22.00	1.75 "

For the first time in the history of Brooklyn proposals were made to supply arc illumination for the streets. The propositions were handed in by representatives of the Brooklyn and Municipal Electric Lighting Companies—the former to furnish the Western and the latter the Eastern Districts of the city with such lights as might be awarded them. It would not be surprising if they did obtain an award this time, as we note that Mr. Hugh McLaughlin (otherwise known as the "Democratic Boss" of the city) is interested in the first named concern. The annual charge for each "arc" was fixed by both companies at $255.50, a familiar figure to New York taxpayers.

[A Paper read before the Society of Gas Lighting.]

Suggestions for Reflection When in Thoughtful Mood.

By Joseph R. Thomas, C. E.

It was the desire and intention of those most active in the formation of the Society of Gas Lighting that its chief aim and object should be the bringing more immediately and intimately in contact with one another those persons engaged in the manufacture of illuminating gas in the vicinity of New York. The supposition was that a Society of this nature could not fail to operate beneficially, in so far as regarded the mutual improvement of all those connected with it, through the obtaining of an increased store of knowledge on all matters appertaining to the subject of gas manufacture; and the natural effect of this advance in knowledge must of necessity result advantageously in more fully preparing the recipients thereof for the successful prosecution of the business in which they are engaged, and therefore enable them to conduct that business in a more intelligent and satisfactory manner both to themselves and the companies represented by them.

In thus meeting together as a Society it was fair to presume that the persons composing the same would become quite intimately acquainted with one another, and it was quite in line with the presumption that the outcome of such intimacy would be to make them ready and willing, at any and all times, to impart, upon any subject brought before the Society, any particular or desired information possessed by the one and sought after by the other.

In order that the members might be brought frequently together, it was so arranged that the meetings of the body should be held monthly, and, further, that the sessions should take place alternately at the works of some individual member attached to the Society. It was foreseen that the provision made for meeting at the different gas works would develop frequent opportunities for making practical examination into the merits of any new apparatus installed in the plants—in short, furnishing certain means whereby critical inspection could be made upon any new departure in the method of accomplishing work intended to develop economy in gas manufacturing establishments.

Another feature proposed by the originators of the Society (and one rightly considered as of the greatest importance) was that papers, treating on some topic of general interest to the members, and intended to convey the writer's own ideas on the theme selected, were to be presented at each of the monthly sessions.

Now, to briefly sum up the case as it stands, in the attempt to determine whether the aims of its founders have been realized, I beg leave to say it is my honest conviction that the original objects have been attained; and that the outcome has been of very material benefit and advantage to us all as members of this Society, and furthermore has furnished us many an occasion on which we experienced a thrill of honest and justifiable pride when considering the uniform measure of success and progress that has attended our growth. The meeting together at the various gas plants has afforded the opportunity for critical inspection, examination, and comparison which it was designed to create; the presentation and reading of papers has had the desired effect of at once placing before us matter calculated to enhance the interest felt in attending the sessions, and stimulating that free interchange of opinion, through the medium of the ensuing discussion, which is best assured to inculcate and foster honest business intimacy.

This manner of freely, fully, and fairly discussing the various points relative to the merits or demerits of any new thing proposed is pretty sure to lead to a thorough sifting. A still further advantage of the practice of discussion will be found in the fact that a member, instead of relying simply and solely upon his own judgment, on matters that may have a most important signification to himself, owing to certain pressing force of circumstance or position, may have the benefit of the combined opinion and experience of his fellow-members.

If it be true, as it is said, "In a multitude of counsellors there is wisdom," then it should follow that, in the bringing up of any new matter before the Society, in the way mentioned, and after fair and free discussion is had, the information thus acquired would enable each and every one to reach the point of readily determining the most advantageous course to be pursued under identical circumstances.

Since the organization of the Society of Gas Lighting—now nine years—many things have been brought to our notice, all in the line of the same praiseworthy object—reducing the cost of gas manufacture. Among the most prominent of these may be mentioned the erection of a better class of benches, and the adoption of improved apparatus and methods for cleansing and purifying. In the operation of our plants the yield from a bench of retorts has been materially increased beyond that which was formerly obtained at not such a long period ago. This gratifying result has been brought about by the employment of larger carbonizing vessels, their better setting, and the institution of improved firing methods. Judging from the great strides thus far made in this direction, it seems only fair to assume that the end has not yet been reached, and reasonable to surmise that well-directed and earnest application on the part of those prosecuting their researches on the subject may be trusted to develop still better practices for performing the work, and, at the same time, be also in the line of economy.

In referring back some years we may easily bring to mind the period when the maximum yield from a retort did not exceed 3,000 or 3,500 cubic feet per diem; and this, at the time, was considered a very good result. The increased yield gained from a working retort has advanced between that time and this, until now we are able to note in our ordinary operation retorts capable of a per diem production of 10,000 cubic feet. This glance over what has been accomplished in increased yield per retort during intervening periods, not so widely separated either, will simply show what great production gains have been already secured, and prompts us to believe that the ungleaned field opening up before us is yet large indeed.

Improved methods of firing have occupied a large share of attention, and the various forms of regenerator furnaces all have their advocates. In the substitution of these systems for the common old-style furnace, it is asserted, and no doubt truthfully so, by those who have employed them, that a very great saving in fuel expenditure is secured. Some supporters of the regenerator furnace claim that they can (and do) accomplish carbonization with a use of but 20 per cent. of the coke produced. This is undoubtedly a very low figure, and is also a much lower one than that claimed by some others who employ the advanced firing system—these latter asserting that from 25 to 30 per cent. of the coke product is required to maintain the heats at the necessary temperature. But aside from the item of precise percentage, any saving of fuel is an undoubted move in the right direction, since coke saved may be set down as coke gained—every bushel of the gain meaning so much more to the credit of the residual account.

And while talking about coke as a fuel, not alone in its use about a gas plant, but with reference as well to its value as a steam producer and a domestic agent, it seems worth while suggesting that the topic is well worthy of consideration on the part of every gas works manager. It is a fact, and its truth ought to be well known, that coke fuel has a far greater domestic value than that ordinarily assigned it. In domestic use it is more easily manageable, and its fire may be kept alive more readily, than is the case with its competitor, anthracite coal; and, besides, the question of relative economy is all in its favor. These assertions only require for their substantiation, on the part of all, a trifling amount of investigation, and are advanced by the writer as the result of his own careful observation. The present plan of domestic heating agent is all sufficient for its economical use, no matter whether it be the usual Baltimore heater, self-feeder, or kitchen range. In all such vehicles coke may be relied upon as a faithful and efficient substitute for anthracite coal as far as calorific effect is concerned, and the substitution can be made with the agreeable feature of being an economical transaction. These opinions have been verified by the experience gained in years of personal use of this residual.

Now, it is to be regretted that most of our gas managers have been quite dilatory in their attention to such a simple matter—that of neglecting to suitably prepare their coke product to fit it for general domestic consumption, by crushing it to suitable sizes. At the present time, in a great majority of localities, it is impossible for the householder to obtain any large quantity of the material suitably prepared for instant use. If care were taken to remedy this unpleasant (because unthrifty) order of things, and were the people thoroughly informed as to the efficiency and economic value of the material sought to be disposed of, instead of finding the yards of gas works encumbered with huge coke piles, as unfortunately is often now the case, the time would speedily arrive when the supply would be unequal to the demand. It is therefore in the line of advance that this defect be remedied—prepare your coke, let the people know you have done so, instruct them as to its use, and there can be but one result. A pleasant one certainly to yourselves, as it hardly needs be said that increased residual receipts are in every way satisfactory to the company you represent.

Yet another thing bearing upon the coke question, and to which I may be forgiven for referring. The question has often been raised at the meetings of our various gas associations—it is simple enough in itself, but it nevertheless has appeared with disheartening regularity—and that is, "What quantity of coke is produced from a ton (2,240 lbs.) of coal?" Now, although a very simple thing, this is a matter of great importance to every gas manager, and in more ways than one. This mooted point should be settled definitely, and it might be borne in mind that mere guess work will not do; but if a permanent basis is to be arrived at, careful investigation and faithfully continued experiment must constitute the groundwork in order that the matter may be settled absolutely. The quantity and quality of coke produced from a ton of coal is a most important factor in determining the value of a coal as a material for carbonization. From a long continued series of experiments which the writer is conversant with it was found that the coke product of several well-known American coals was as follows:

Kanawha cannel, 32 bushels; best qualities West Virginia, 36; West-

moreland (Pa.) County coal, 42 bushels—bear in mind all results given are based upon a ton of 2,240 pounds. From these figures it will be recognized that much of the confusion attaching to the coke discussions in the associations, as reported from yields obtained in different plants, arose from the fact that the stated product was obtained from coals having widely differing characteristics.

To carry out this question of coke product a little more fully, let us assume that the mixture being carbonized at a stated time is composed of 90 per cent. of the Westmoreland County coal and 10 per cent. of cannel. At this proportion we shall obtain the following result from the mixture:

Coke product from 10 per cent. of cannel	3.2 bushels.
" " 90 " Westmoreland	37.8 "
Or a total of	41.0 bushels.

With this mixture—

Coke product from 10 per cent. cannel	3.2 bushels.
" " 90 " West Virginia	32.4 "
Or a total of	35.6 bushels.

Assuming that for carbonizing and all other fuel purposes about the works 33 per cent. (or 11.6 bushels) is employed, then we would have left over for sale, with the first mixture, 29 bushels; with the second, 24 bushels. From these simple figures it will become evident how important an item, in determining the value of a coal proposed to be introduced into a gas works, is the factor of its coke producing capacity. To resolve this question, as above illustrated, into the matter of dollars and cents:

The cost of coal in case of first mixture, at present prices, would be—

10 per cent. of cannel, at $9.50 per ton	$0.95
90 per cent. of Westmoreland, at $4.35 per ton	3.91½
Or one ton of the mixture	$4.86½
Deduct 29 bushels coke, at 7 cents	2.03
	$2.83½

In the case of second mixture—

10 per cent. cannel, at $9.50 per ton	$0.95
90 per cent. West Virginia, at $4.25 per ton	3.82½
Or one ton of the mixture	$4.77½
Deduct 24 bushels coke, at 7 cents	1.68
	$3.09½

Then we see that the difference in cost of the two mixtures (for the coal alone) is shown to be 26 cents per ton in favor of the first. To arrive at precise accuracy as to the relative value of coals as gas producers, it will of course be necessary to take into critical account any increased yield, candle power, and cost of purification of one mixture over the other. But it is in such plain, matter of fact ways that a gas works manager may determine what is the most profitable description of coal to carbonize, and also enable him to estimate accurately the price he should pay for any sort of coal intended by him for mixing purposes. This latter he can accomplish by taking the price at which a standard coal is rated in the market, and making the equation from the cost and value of that in comparison with the value of the sort he may make trial of. There is in the long run no doubt that the best coal obtainable will ultimately prove the cheapest; and although some other grades may be offered at what at first seem much lower rates than those asked for the standard quality, it is just as well to place yourself in that position where you may know to a certainty whether the figure demanded for the poorer sort is one that will be for the interest of your company to purchase it at all. This plan is the much better and safer one to pursue.

Another matter which has demanded, and is now demanding, serious consideration is the piratical raiding made on gas investments all over the country. It is a sorry state of things to make confession of, that, despite our proud boast that we are a people guided in all affairs by a love of fairness and honesty, this wretched system of blackmailing seems to grow and flourish upon the foulness which it breeds. Judging from our past experience of these nefarious schemes, their promoters may be depended on to continue in their depredations until legal methods are devised for the proper protection of moneys honestly invested in gas plants. It goes without saying that such protection should be granted, and it is also certain that these measures will never become inscribed on our statute books until a unification of interest on the part of those holding gas securities shall have been arrived at. This amalgamation of interests must certainly in time become imposing enough to make the law framers feel its weight, and might be trusted eventually to compel the propagation of laws having for their object the protection alike of gas shareholder and gas consumer.

The apparent ease and facility with which these raiders obtain the privilege of entering into a city or town, by the specious (but how often exploded) pretence of their desire to organize and operate a gas company solely for the public good, is rather astounding. One should suppose that this sort of sirenical operation would have long ceased to have any potency for the public ear; but the fact that the threadbare chord may still possess enchanting timbre only goes to show how gullible is that collective body known as the "dear public," and how willing it is to dance, even though it may afterward be rather disquieted when the account of the piper is handed in for settlement. The complete fallacy of the opposition pledge has been shown time over and again in the past, and this state of the case proves of necessity how like unto those of the past will be the promises of the future.

Suppose we take, as our first example, a case right near at home, to show how opposition benefits (?) the gas consumer. We find in New York city eight gas companies engaged in supplying the inhabitants of the Metropolis with artificial light. Can it be questioned for a moment that all the gas required for their wants could have been made and supplied at cheaper rates than now charged if the three original companies had been left in undisputed possession of the field? The excess of capital represented by the at least five surplus concerns has been such as to effectually bar cheap gas in New York. This is plain to anyone of ordinary intelligence through the consolidation measures recently enacted and cemented in this city, whereby one vast corporation has been formed by the union of the old companies, with an aggregate capitalization of, in round numbers, about $39,000,000; whereas, had the three pioneer companies been properly protected in their just and equitable rights, even should consolidation at any time have been effected by them, the joint capitalization, allowing the outside figures, need not have exceeded $20,000,000. Despite this plainest of evidence, the "dear people" are still so blind (it may be, though, that their representatives are venal) that since the consolidation spoken of a new company has been granted a charter to operate a plant within certain limits of the city.

In Chicago, Ill., an old established company with possession of all the capital necessary to operate a works in that city, and equipped with every appliance requisite to the conditions of cheapening manufacture and selling at low rates, has been hounded by the gentry in opposition; and so well did the promoters of the scheme "feather their nests," that possibly a few particulars regarding their Lake City operations may serve to illustrate (if not to adorn) the example.

The opposition company was capitalized in the total sum of $5,000,000, divided into three-fifths stock and two-fifths bonds—these latter bearing 6 per cent. interest. The entire expenditure on plant and appurtenances did not cost the promoters a greater sum than one-half the bonded debt. Who got the balance? And what did those who got it do with it? Certainly the gentlemen who divided up the stock were in position to have accurate knowledge as to the likelihood and ability of the company earning a dividend on such highly diluted financial standing; therefore, knowing all these things, what is more likely than that they should let some of the unwary and confiding people in on the "ground floor?" Alas, it is to be feared that those who were admitted so near to the surface have since found out the trap-door that led into a sub-cellar. Money cannot be honestly made in such schemes; but money can be made by "going in" for the fleece of the warmly-clad lambs—innocent, confiding creatures they are; and how they do merit our sympathy when the motives that enticed them into the arms of the shearer are laid bare. Still, the little game is constantly repeated; they are gathered on the river bank, the shears are applied, their warm coating is ravished from them, and then are they ruthlessly cast out into a temperature financially below zero. Stranger still, though, hardly has the kink in their coats been restored in due process of time before they once more get "in on the ground floor."

At one time, in the city of Baltimore, Md., gas companies multiplied with such rapidity that their increase somewhat resembled a financial problem almost akin to the provision of nature in the matter of the fecundity of cats and rabbits; and some were disconcerted to that degree they almost feared the city's limits would be scarce large enough to contain the plants sought to be erected within them. These timorous ones have had their fears allayed, at least for a time, since a halt has been called and a union of forces effected. But at what cost has the result been attained? The figures tell the story. What with stocks and bonds, the amount foots up to the neat sum of $12,000,000. Those conversant with the population and lighting demands at the present time in the Monumental City know full well that a capital load of three millions would be more than ample for its every need, so far as the gas maker's industry is concerned. Cheap gas is simply an impossibility in the future history of Baltimore.

Coming back once more to the region of home, look over across the narrow limits of the East River, and behold the situation in Brooklyn, N. Y. A single glance is enough; and to you who are so thoroughly conversant with all the nauseating details of the "gas deals" there made in the last ten years a recount of the particulars is unnecessary. The case in the City of Churches is a most aggravated one, and has been peculiarly disastrous to many small investors who in good faith put their scanty store of savings into gas stocks. It has also been equally disastrous in its results to the gas

consumer. Just think of it; many a consumer is obliged to pay $2.50 a thousand cubic feet for his supply, and all because of opposition.

Example after example might be cited, but enough has been said in support of the proposition that it certainly is high time concerted action should be taken to put an end to this disgracefully prevalent system of extortion and robbery.

Reverting once more to the doings of the Society, by way of conclusion I can refer with much pleasure to our sessions during 1884. The interest in our meetings has been well maintained by the members, and the papers presented, together with the discussions on same, have not only been interesting, but really valuable as well, in that some of them have made clear to us certain points in the practice of our mutual profession. I need not exhort you to keep up the good work—the record of our past is the surest indication of our zeal for the future.

It has been our misfortune during the past year to lose by the grim hand of death an honored member, and our late Vice-President, Mr. Charles Vandervoort Smith. To you who have been intimately associated with him, not only in this Society, but also in connection with matters allied to our business, as also in the friendliest of social relations, words of eulogy regarding his character and manly qualities are entirely unnecessary. He was a man who, with an opinion once formed on any topic, ever remained steadfast to his convictions; but these convictions, when analyzed, were sure to be found the result of a careful investigation into the merits of any subject brought to his notice. Gentlemanly and kind in all his dealings with those with whom he was brought in immediate contact; genial, frank and earnest in his intercourse with us, his memory will be treasured up in fond remembrance by those who knew him well and loved him most.

The Society has been particularly unfortunate in the frequent gaps made in its ranks by the grim harvester. The first to join the silent majority was Mr. Geo. W. Edge, followed at all too brief intervals by Mr. Geo. Dwight, Major G. Warren Dresser, and Mr. C. Vandervoort Smith. Noble Romans were they all—men who, during their stay amongst the living, devoted the fullest measure of their rare talents and abilities to the development and progression of our mutual calling; and who for sterling character and true worth were ever recognized in the foremost rank. But if the chilling hand of death has removed them from us in the person, the fleshless monarch is powerless to destroy the example they afforded us in their upright careers, which remain to us as powerful incentives for the faithful performance of our whole duty in whatever position has been assigned us.

[From Journal of the Society of Arts.]

On the Use of Coal Gas.

By Harold Dixon, M. A.

[The following article is the first of a series of three lectures delivered by the author before the Society of Arts (London, England), on the above named topic. This series is the first of the regular course of Cantor Lectures annually presented to the Society, and the succeeding portions of Mr. Dixon's discourse, "On the Use of Coal Gas," will be given in the Journal. The lecture herewith reproduced was delivered on the evening of Monday, Dec. 1, 1884.]

Coal gas is a mixture of invisible gases which are produced by the destructive distillation of coal. To-night I do not intend to say anything about the processes employed in the manufacture of coal gas or the methods used for its purification. I am going to speak to you about the physical properties of the gas as it is delivered to us from the gas mains—to consider what kind of a body this coal gas is, what are the products of its combustion, and the methods in which it may be burnt.

First of all we may take, as it is the most striking physical property, its inflammability. When a heated body is brought into coal gas escaping into the air, it ignites and burns with a flame sometimes luminous, sometimes non-luminous, according as it is mixed or unmixed with air. In the case of gas escaping directly into air from a pipe we have a luminous flame; where the gas first mixes itself with air we get a non-luminous flame, and of these non-luminous flames there are several kinds, from an explosion, on the one hand, when a very rapid inflammation of the mixture of the gas and air passes through the whole mass of it, to the gas and air burning quietly, on the other hand, as I have here in this Bunsen burner. Let me show you first of all a few experiments on the inflammability of coal gas. If we take an ordinary bit of wood and light it, and in a short time blow it out, so that we have a glowing red end, and bring it into escaping coal gas, we find that it does not light it; bring something hotter—a poker at a fairly bright red heat—and this also fails to ignite it. I will compare it with a jet of hydrogen; the difference between them is fairly well marked. The poker is visibly red-hot, but it fails to ignite a jet of coal gas, whereas it ignites a jet of hydrogen gas. Coal gas is ignited only at a very bright red heat; a poker has, for instance, to be a bright red, visibly red in daylight, in order to ignite coal gas; hydrogen is ignited at a slightly lower temperature. Coal gas contains about half its volume of hydrogen, but, curiously enough, it is not ignited at the same temperature that hydrogen is ignited at. The other large constituent of coal gas, viz., marsh gas, ignites at a still higher temperature. Davy, who experimented first on the ignition points of gases, says that an iron bar must be at a white sparkling heat in order to ignite marsh gas. Now hydrogen, we have seen, ignites readily enough with a red-hot poker; coal gas is not ignited with a poker that is visibly red-hot; it will, however, ignite when the poker is at a cherry-red heat.

The constituent of coal gas next in bulk is carbonic oxide. That ignites almost at the same temperature as hydrogen; it is very difficult to detect the difference between the two igniting points. But there is one constituent of coal gas present in a very small quantity, viz., bisulphide of carbon, which ignites at a very low temperature.

If we take a little liquid bisulphide of carbon and pour it into a glass vessel so that it will mix with air, we find that this mixture of air and carbon bi-sulphide vapor is exceedingly inflammable. I will warm up this glass rod and you see it ignites the vapor readily. The temperature of the ignition of carbon bisulphide vapor and air is about 300° Fahr. Now it might be supposed that the presence of a minute trace of the vapor of carbon bisulphide would confer its inflammability on coal gas. If we mix a little of this vapor with hydrogen, or with carbonic oxide, we find that it does confer its inflammability on those gases; but if we mix it with another constituent of coal gas, viz., olefiant gas, we do not find the inflammability of carbon bisulphide given to the mixture. The presence of olefiant gas destroys the low igniting point of a mixture containing carbon bisulphide. This is curious, but I know no explanation of the fact, It was, I believe, originally discovered by Dr. Frankland, who experimented with these various mixtures, and found that a mixture of olefiant gas with carbon bisulphide ignited at no lower temperature than olefiant gas itself.

Now, marsh gas is the constituent of coal gas which ignites at the highest point; then comes olefiant gas, then hydrogen, then carbonic oxide, and then this carbon bisulphide; but the coal gas itself ignites at about a mean temperature—that is to say, at a cherry red heat. Now I will show you another experiment on the ignition point of coal gas. We may cool gas down until we put it out. There is for every gaseous mixture a certain temperature at which it will burn, and below which it will go out; and if we place in the flame a mesh of iron or copper wire so as to conduct the heat away from the gaseous molecules, we may cool the flame down below its ignition point. Let me take a large mesh and put it down over the flame; the flame passes through it; there are not enough pieces of wire to conduct the heat away and bring it down below the ignition point. If we take a mesh a little smaller and bring this down on the gas flame, we find the gas put out; the coal gas passes readily through the mesh, as we see by its igniting when the mesh is red-hot. Taking a still smaller mesh, we find the flame is put out completely—that is to say, this mesh of iron wire conducts away the heat of the gas and brings it down below its ignition point. On this principle safety lamps are constructed; and I will say just one word about them. Safety lamps have been made for use in coal mines, where the gas which is met with is marsh gas. I believe that no free hydrogen, and no free olefiant gas is found in coal mines; it is all marsh gas. Now, marsh gas has this exceedingly high ignition point, and therefore, a safety lamp which is quite safe in a mine with a mixture of air and marsh gas, is not safe in a mixture of coal gas and air. To insure safety in a mixture of coal gas and air one must make the mesh of the lamp still smaller than is used in mines.

Now, the next property of the gas, one which follows from this, is the fact that it burns with a flame in air. This burning with a flame is entirely a relative phenomenon. The molecules of the coal gas, viz., the hydrogen, the carbonic oxide, and the hydrocarbons unite chemically with one of the constituents of the air, viz., oxygen, and in this chemical union the vibrations are produced which give us the sensation of light. Whenever we have two gases uniting chemically together at a high temperature we have this phenomenon of flame, but on no other conditions. A solid body burning in a gas does not give a flame, only one gas uniting at a high temperature, or burning with another. Now, if we lived in an atmosphere of coal gas, it would follow that coal gas would not be a combustible substance, but the air would be, and oxygen in a still higher degree. Flame occurs at the bounding surface between two gases entering into chemical combination one with the other. I can show you an experiment where a flame of air may be seen burning in coal-gas, as well as a flame of coal gas burning in air. In this little apparatus on the table there are two tubes entering through the cork at the lower end, one of them broader than the other; one to admit air, and the other coal gas. I will connect one of these tubes to the gas supply so as to let coal gas enter into it and fill the glass globe. We have now an atmosphere of coal gas there, but since there will be an upward current it will draw some of the air into the globe through the other tube. This jet of air is now lighted, and on lowering the lights of the room you

will be able to see, especially when the moisture which is first of all precipitated on the sides of this globe has disappeared, that the air is burning in the atmosphere of coal gas. To make it a little brighter, I will push up a platinum wire with a borax bead at the end so as to color the flame. That it is really air burning in coal gas I can make plain by lighting the excess of coal gas which is now pouring out at the top of the globe. There you see coal gas at the top burning in air, and underneath the air burning in the coal gas. I have to stop the supply of air to put the flame out, otherwise there would be an explosive mixture formed and an explosion inside.

Before I pass on to treat in more detail of the chemical constituents of coal gas, I will try one or two more experiments on its physical properties. Let us consider now its specific gravity. An easy way to show that is to blow a soap bubble with it. With the pressure of coal gas we have here we can blow a bubble, and if I am skilful enough to detach it you will see it rise, showing how much lighter it is than air. [On rising a short distance the soap bubbles were ignited by a taper.]

Now, of the constituents of coal gas, hydrogen is by far the lightest; next to it comes marsh gas, after that carbonic oxide. The other constituents are comparatively heavy. One of the properties of a light gas is its power of passing rapidly through a porous substance, such as plaster of Paris, or compressed graphite. The explanation of this, on the dynamical theory of gases, is, as you know, that the gases are composed of a number of small molecules dashing about in straight lines, and coming into collision one with the other and with the sides of the containing vessel; and where there are minute interstices in the walls of the vessel the molecules pass through these interstices, and we find an exchange of the gases outside such vessel with the gases inside. Now consider, first of all, for the sake of simplicity, the case of two gases well known—oxygen and hydrogen. If we had a porous vessel with hydrogen inside, and oxygen outside, we should find that the hydrogen penetrated through the interstices of the vessel four times as fast as the oxygen went the other way. On the dynamical theory of gas this is explained in the following way: Hydrogen gas is made up of a vast number of small molecules of hydrogen, and oxygen gas is made up of a vast number of small molecules of oxygen; and the hydrogen molecules are traveling four times as fast as the molecules of oxygen. So that, taking any given portion of the surface of the vessel, and considering what number of collisions there will be between the hydrogen and the oxygen molecules respectively and this surface, we see that if there are the same number of molecules in the two gases, and the hydrogen molecules are traveling four times as fast as the oxygen molecules, the hydrogen molecules will come into collision with this surface four times as often as the oxygen. Now if there are a certain number of interstices in this surface through which these gases can pass, the quantity of hydrogen which will go through will be four times the quantity of the oxygen which will go through in the same time. That is the explanation of the phenomenon of diffusion on the dynamical theory of gases. Let me show you a few experiments in which this diffusive power of coal gas, and especially of the hydrogen and marsh gas contained in it, comes into play. The gases pass through the walls of a porous vessel, and decrease or increase the pressure within the vessel according as more gas comes from the inside to the outside, or from the outside to the inside. This vessel is made of one of those porous pots used in a Bunsen cell; I have closed it with a paraffin cork, through which I have passed a long glass tube. I dip this open end in a colored liquid. Now as it stands here in the air this vessel is full of air, and it is surrounded with air outside, the two being of the same density; so that the same number of molecules of air are passing out from the inside of the vessel into the atmosphere of this room as are passing from the atmosphere of the room into the inside of the vessel. The pressure, therefore, inside remains constant, and if we put any colored liquid into the tube it remains perfectly stationary. But if we plunge the vessel into a lighter gas, such as coal gas, on the theory we have been considering, this coal gas, or some of its constituents, will pass more readily through from the outside to the inside than the air which is now inside will come out, consequently there will be an increase of the quantity of the gas inside, the pressure will be raised, and we shall find bubbles of gas escaping from the end of the tube. I can put this into an atmosphere of coal gas by placing this glass jar over it, and, by means of an india rubber pipe, letting some gas into it. Bubbles of gas are now pouring out from the end of the tube, and I stop the supply of gas. Now what will happen? There is a certain amount of coal gas gone in, and it has driven an equal volume of the air out. If I take the glass jar away we now substitute the air for the coal gas outside, and you see the liquid rush up the tube, showing a diminution of pressure. If I put the glass vessel containing the coal gas back again over the porous vessel the pressure is increased, and the liquid is driven down again. You see, corresponding with the nature of the atmosphere outside, you have the variation of pressure inside accurately marked by the rise and fall of a column of colored liquid in the tube connected with the porous vessel.

Now, an instrument could easily be made—I think a French engineer has made such an instrument—by which the presence of coal gas would be detected in a room. I know such an instrument has been used in mines to detect the presence of marsh gas. If instead of colored water in this tube we had mercury it would not run up so far, but it would run up several inches, and if we went into an atmosphere of marsh gas with this porous vessel filled with air, the marsh gas would enter more quickly than the air would pass out. The pressure inside would increase, and consequently the mercury would be down. Now it would be easy to cause the mercury to make metallic contact with a wire, and so connect a battery with a bell. Taking such an instrument as this into a mine, if there were a certain percentage of marsh gas present it would increase the pressure inside sufficiently to drive the mercury down until metallic contact was made, and then a bell would be rung. Exactly the same thing would do for coal gas. If one wanted to know whether coal gas was escaping anywhere, one might have such an instrument as this connected with a tube of mercury, two electric wires, and a Leclanché cell, and the wires might be carried to an office at any distance and connected with a bell. Then whenever coal gas escaped into the atmosphere where this porous vessel was, the pressure would increase inside, electric communication would be made, the bell would be rung, and you might go and find out where the escape was. I merely suggest that as a method which would be easily applicable for discovering at a distance whether there was an escape of coal gas.

One effect of this rapid diffusion of the very light hydrogen and marsh gas in coal gas is this, that these light gases mix themselves rapidly with air and form an explosive mixture with it. It is the presence of hydrogen in coal gas that makes it dangerous. Owing to its lightness hydrogen siphons itself upward through a bent tube. Here is a little apparatus to illustrate this siphoning of the hydrogen, and also the rapid diffusion of hydrogen with air, in order to form an explosive mixture. The same experiment may be made with coal gas, but it takes a longer time. The apparatus consists of a cylinder hanging by an upright, inverted and closed at the lower end by a piece of paper stretched round it by an india rubber ring. Passing through a hole in the paper there is a U tube with its shorter arm at the upper part of the cylinder. The longer arm is outside the cylinder; to it I can attach a tube from a hydrogen apparatus. By turning on the tap I can pour hydrogen into the cylinder. Hydrogen, being lighter than air, will displace the air at the top of the cylinder, and drive it out at the bottom; but it will not only do that, it will also diffuse with the air. I will, first of all, pass hydrogen in until I judge the cylinder is pretty well filled, then I will take off the tube here and allow the hydrogen in the cylinder to siphon itself up the longer arm of the U tube. Then as the hydrogen siphons itself up some air will be drawn in at the bottom, and owing to its rapid diffusive property the hydrogen will mix itself with the air, and we shall get an explosive mixture inside the vessel. The flame at the top here will begin to jerk, and perhaps to sing, and then it will run down and fire the explosive mixture. We must allow it a few minutes to fill before it would be safe to light. I now light the hydrogen at the end of the U tube. There is the hydrogen burning and siphoning itself up. Now it is beginning to sing, and the explosion follows.

I will now show an experiment on the power of platinum to light a mixture of coal gas and air by allowing a slow combination to take place between the hydrogen and oxygen of the air. Owing to this chemical combination the platinum increases in temperature until it reaches the ignition point of the gas. I warm up this little spiral of platinum, then take it out of the flame and allow it to cool, and put it in an unlighted jet of gas; it becomes hot, glows, and finally lights the gas. That is one way in which I have attempted to determine the different ignition points of these gases. It is not a very accurate way, but still it gives some approximation towards the truth. The platinum has to attain to a bright red heat before the coal gas ignites.

I will now go on to consider in more detail the various constituents of coal gas. I have written on the blackboard approximately the composition of ordinary coal gas. The hydrogen varies between 40 and 50 per cent., sometimes a little over 50 per cent.; but in no analysis I have ever seen or made have I found over 51 per cent. We may take it roughly that the hydrogen is 50 per cent. of the coal gas. Marsh gas varies between 35 and 42 per cent. I have taken it at 40 per cent. Carbonic oxide varies from 6 to 8 per cent.; and the most important of all, ethylene, and the other hydrocarbons of the same chemical type as ethylene, which may be classed together as olefines, occupy 3½ volumes of the 100. In the next column I have put the volume of oxygen required to burn each of these constituents of coal gas. The 50 per cent. of hydrogen requires 25 per cent. of oxygen. The marsh gas requires double its volume of oxygen; the carbonic oxide requires half its volume; the olefines require about six times their volume of oxygen to burn them. In the next column are arranged the volumes of steam produced by the burning of these various constituents: 50 per cent. of hydrogen requires 25 per cent. of oxygen to burn it to 50 per cent. of steam. In the last column is put the volume of carbonic acid produced by the burning of these various constituents. Hydrogen gives no carbonic acid, for it contains no carbon; marsh gas produces double its volume of steam, and its own vol-

ume of carbonic acid; carbonic oxide, no steam, and its own volume of carbonic acid; and the olefines form about 20 volumes of steam and 14 volumes of carbonic acid.

With the properties of hydrogen most of us are familiar. It burns readily in oxygen, and explodes if mixed with half its volume of oxygen. It burns in air with a non-luminous flame. I can attach to this Kipp's apparatus a lamp in which the hydrogen may pass directly up to this steatite burner, and there we can light it. I have put into the body of the lamp some liquid olefines to show the influence of these hydrocarbons on the flame. You see the hydrogen gives barely any light at all; but by mixing it with a slight trace of the vapor of the hydrocarbons belonging to this olefiant series, we immediately get a brilliant flame.

I have prepared samples of these various constituents of coal gas. All of them are invisible. Here is oxygen, carbonic oxide, marsh gas, and ethylene. I will show you as quickly as I can one or two experiments with these gases. First of all, the union of hydrogen and oxygen to form water. By means of this pneumatic trough I pass a little of the hydrogen into a glass explosion tube, so as to fill it roughly two-thirds full; then mixing oxygen with it, I ignite it. You see the flame gives scarcely any light, but there is a loud report, owing to the sudden production of a volume of steam at a very high temperature. I will not take up your time by showing the explosion of all these gases, but I will light one or two of them in the air. Here is some marsh gas. After the first moment the flame becomes blue and almost non-luminous. The other constituent of coal gas—viz., carbonic oxide, of which there is 6 to 8 per cent.—burns with a characteristic blue flame, with the oxygen of the air to form its own volume of carbonic acid. This is a bottle containing ethylene. I will fill a small jar with the gas, so that the air can get at it rather better than it can in this bottle with the narrow neck. Under the water of the pneumatic trough one can easily transfer the gas from one bottle to the other. This ethylene has an exceedingly luminous flame when one burns it in this way in the air, but it always smokes; and an illuminating gas made with a very large percentage of ethylene would smoke unless it were burned with certain precautions.

If we ignite a mixture of coal gas and air, we find that if the mixture is made in the right proportion we get an explosion. If the mixture is made in other proportions, with either more or less air than a certain quantity, it will not explode. The limits of explosion are from 3½ to 9½ volumes of air for every volume of coal gas. Of course coal gas differs a little in its qualities, and so the limits cannot be exactly defined; but those are about the limits. If you mix four volumes of air with one volume of coal gas, a flame will be propagated through it; and if you mix nine volumes of air with one of coal gas, a flame will be propagated through it. I will try one or two experiments of this nature, mixing a certain volume of air with a certain volume of coal gas. First, I will take the lesser quantity of air. I have filled this glass cylinder with air, about two-thirds full, and I will now fill it up with coal gas. We shall find we are just on the limit of an explosion. We may be just on one side or the other; I cannot tell. I plunge a lighted taper in suddenly; the mixture burnt, but there was no explosion down the tube—it simply burnt where the air got access to it; so that three volumes of air to one of this gas is not explosive. I will now go to the other extreme, and take nine or ten volumes of air to one of coal gas. This is just within the limit; there is a slight explosion, but hardly any noise. I will now repeat the experiment, taking one volume of coal gas to five or six of air. Here we have a sudden inflammation of the mixture, accompanied by a report. No great noise is made when only a small volume of coal gas and air is exploded in this way, and I think it is for this reason: The flame has to travel a considerable way down the cylinder or tube containing an explosive mixture of coal gas and air before what is known as the explosive wave is propagated; and as this is a matter of very great importance, I should like to say a few words upon it.

Until four years ago the rate at which a mixture of oxygen and hydrogen was supposed to burn down a tube filled with it was 34 meters, or 37 yards, a second. This was the determination of Professor Bunsen, of Heidelberg. The rate at which flame traveled down a tube filled with carbonic oxide and oxygen was found by Bunsen to be only a little over one yard a second. The investigations of M. Mallard brought out this conclusion in the case of coal gas and air: The maximum velocity of explosion was obtained when one volume of coal gas was mixed with five of air; and that velocity was about three feet a second, or about the same pace as the velocity of explosion of carbonic oxide and oxygen. Berthelot was the first who showed that these rates of explosion were enormously underrated. About the same time, but shortly afterward, I was experimenting on the explosion of gases, and a question arose as to the effect of a small quantity of a particular gas on the explosion of two others. To determine that, I thought it would be a good plan to measure the velocity of the explosion of these gases with different quantities of the third. I arranged an apparatus to measure this explosion; but I found the rate of explosion was infinitely greater than I had the means of measuring. Whereas I was thinking to measure a velocity of three or four yards a second, the explosion that happened in my tube certainly went hundreds of yards a second; and I was totally unable to measure it. I saw, at all events, that the explosion was vastly quicker than was supposed.

Shortly after I did that work I came across Berthelot's paper, which was just published. He found that hydrogen and oxygen exploded at the rate of more than 1,000 meters a second. I determined to repeat these experiments, and put up a very delicate apparatus for the purpose. I am happy to say that my results came out exceedingly concordant with the later results of Berthelot. I used a tube 200 feet long, and near each end of the tube stretched a narrow strip of silver foil, which formed part of an electric circuit. When they were broken by the passage of the flame, a current passing through two electro-magnets was interrupted, causing the release of two styles, which made their mark on a moving plate. M. Berthelot employed pieces of tin foil, and placed in them a grain of fulminate; so that when the flame passed by the fulminate exploded and destroyed the tin foil. I did not introduce this extra explosive, but trusted to that which the explosion was perfectly capable of doing—the immediate destruction of the silver foil by the passage of the flame.

I found as the mean of my results that a mixture of oxygen and hydrogen in a pure state, two volumes of hydrogen to one of oxygen, exploded at the rate of 2,817 meters a second—over 3,000 yards; this number being the mean of six experiments. The mean of Berthelot's experiments is 2,810. This is a very close concordance, and I think will be regarded by chemists as satisfactory, showing that the velocity has been measured within a very small fraction of the truth. When you light a mixture of hydrogen and oxygen in the eudiometer, the explosion does not acquire this pace at once, but the gases begin burning slowly, and they gather pace as they go along; for each layer is compressed by the burning layer above it, and each layer burns at a higher and higher pressure, until finally such a pressure is reached that the layer submitted to it is brought up to the ignition point by the heat produced by its compression. The layer below that is also brought up to the ignition point in a similar manner by compression; and thus a constant rate of ignition is maintained. In the case of hydrogen and oxygen the explosion has only to go a few inches in order to establish this constant "explosive wave."

In the case of carbonic oxide and oxygen, Berthelot found as the mean of his experiments a rate of about 1,000 meters; but I found a rate of over 1,500 meters. I discovered that the space given to this mixture by Berthelot to acquire its final velocity was not sufficient; carbonic oxide and oxygen require nearly a yard before they acquire this maximum rate. I have not yet ascertained the explosion rate of marsh gas, as I have only made one experiment on it; but it is something over 2,000 meters a second.

Now these velocities are very considerably diminished when we burn the gases in air instead of oxygen. The nitrogen of the air interferes with the action, because it itself has to be heated up to a high temperature, and, therefore, prevents the other gases reaching such a high temperature as they otherwise would. Therefore the velocity of explosion of coal gas in air is very considerably less than the velocity of the explosion of coal gas in oxygen. I do not know the velocity with sufficient accuracy to give you a number to-night; but it is very considerably greater than that which has been assigned to it.

I can show you an experiment with coal gas and oxygen to compare with the one you saw just now with a mixture of coal gas and air. You saw then that at the extreme limits the mixture just burnt, but there was no noise; at the maximum explosiveness the flame traversed the vessel very quickly, and there was a sharp whistling sound. Here is a little of the same coal gas mixed with oxygen. The loud report which follows the application of a light to this mixture marks the great difference between the burning of coal gas and oxygen and the burning of coal gas and air.

Now, the products of combustion of coal gas—leaving out for a moment the carbon bisulphide—are steam and carbonic acid. The steam is poured out into the atmosphere and mixes with it. If there is an excess of it, and the room is small, there is condensation of the steam on the sides of the room; but in an ordinary room, with ordinary ventilation, you do not have condensation of steam. In the carbonic acid you have a gas which is poured out into the room, mixes with the air, and is carried away in the ordinary processes of ventilation. Steam is considerably lighter than air—roughly speaking, half as light. Carbonic acid is heavier than air. I can easily show you some of the properties of carbonic acid. It is most readily prepared by taking some powdered chalk and pouring on to it some acid, which liberates the carbonic acid. We can easily fill up a beaker with the gas. We find that when we bring a taper into it the light is immediately extinguished. Carbonic acid being heavier than air, I can dip up some of it with a cup, and pour it into another vessel. It pours rather slowly, as it is not much heavier than air. If I have poured any into this vessel I shall have it down at the bottom, and will let a light down and see. You see the jar is two-thirds full, and extinguishes the light at once. Carbonic acid, then, is an invisible, colorless gas, heavier than air. One can take it up in a cup, pour it from one

vessel to another, and it extinguishes a taper. I dip out some of this gas, pour it into a cylinder, and shake it up with lime water; immediately we get a milkiness due to the formation of carbonate of lime, from the union of the transparent lime water with carbonic acid gas. If we place a large vessel over a gas flame we are able in this way to get some of the products of combustion. We can shake up the contents of the vessel with lime water in the way I did just now, and we get the same milkiness as I got before when I mixed the carbonic acid with it. The carbon of the gas unites with the oxygen of the air to form this same gas, carbonic acid. The two products of combustion of coal gas—steam and carbonic acid—are both gases. Steam is a condensable gas, but carbonic acid is not at ordinary temperatures.

Just a word about this other constituent of coal gas and its product of combustion. Carbon bisulphide exists in very small quantity in coal gas, and is due to the sulphur in coal. We cannot get coal without some sulphur in it, and in the distillation of the coal, part of the sulphur of the coal unites with the carbon to form this volatile carbon bisulphide, which mixes with the other gases. Most of the sulphur in coal unites with hydrogen, forming sulphuretted hydrogen; but there is no difficulty in stopping the sulphuretted hydrogen in the purifiers. The carbon bisulphide, however, is more difficult to stop—part of it always comes over; and I believe at present, in London gas, there are about 12 grains of sulphur as carbon bisulphide in 100 cubic feet of coal gas. This carbon bisulphide, when the coal gas is burnt, burns to sulphurous acid; that sulphurous acid somewhat resembling carbonic acid in its chemical properties. It mixes with the air, but under some circumstances it is capable of oxidation to sulphuric acid, and sulphuric acid is injurious to various things which we have in our rooms.

Now, there has been a good deal of dispute as to the nature of the change by which the sulphurous acid coming from a gas flame is changed into sulphuric acid. It has been asserted on the one hand that sulphurous acid, in the presence of steam and the oxygen of the air, is readily converted into sulphuric acid; that you have formed in the atmosphere of a gas-lighted room a cloud of sulphuric acid particles, which are then deposited upon all substances in the room. But, on the other hand, it has been asserted that this could not be the case, for sulphuric acid is only found deposited on hygroscopic substances, and not on all substances in the room indiscriminately. The latter is, I think, the correct view. I think so for this reason: If sulphurous acid and oxygen are brought together and warmed up, they do not unite; they do not unite at the temperature of boiling water. If sulphurous acid and steam—not water, but steam—are brought together, they do not unite. They do not form a molecule of hydrogen sulphite, but they continue to exist as separate gases. Again, if sulphurous acid, steam, and oxygen are brought together and warmed up, so long as the steam remains in a gaseous state the sulphurous acid does not suffer the slightest trace of oxidation. I have experimented on this matter carefully. I have mixed these gases in a eudiometer, having measured them before mixture, and I have kept them in the eudiometer at temperatures varying between 0° and 100°, and so long as no water was condensed on the side of the eudiometer there was no trace of sulphuric acid produced. So that the sulphurous acid coming from the burning of coal gas in the air does not suffer what has been called aërial oxidation by steam and oxygen. It is only when that sulphurous acid meets with water—that is to say, damp surfaces—that it suffers oxidation.

Now what happens in a room lighted with coal gas containing sulphurous impurities? If there are hygroscopic substances in the room, if there are damp walls, if there are basins of water about, if there are certain things very like dry leather, which readily take up water, the water will dissolve the sulphurous acid and form hydrogen sulphite. Now, hydrogen sulphite in a liquid state—that body which we may represent by H_2SO_3—very readily suffers oxidation; so that you find, if you put a basin of water in a room lighted with a sulphur-laden gas, you get the water gradually converted into hydrogen sulphate. Metal-work close over a gas burner condenses steam for a short time after the gas is lighted. The trace of sulphurous acid dissolved by this water is oxidized to sulphuric acid. Every time the burner is lighted the process is repeated; so that, in the course of time, a considerable quantity of sulphuric acid is formed on the metal. If you examine the bindings of books which have been placed up near the ceiling, and have got rotten through heat, you find sulphuric acid there. But I do not think for a moment that sulphurous acid was the cause of the rotting of the book binding; I think the rotting was caused by heat; that the bindings, having rotted, then became hygroscopic and condensed water; that the water dissolved the sulphurous acid, which then was readily oxidized to sulphuric acid. I know people say that on entering a gas lighted room where there is a large percentage of sulphur they can smell sulphurous acid; and I do not doubt that for a moment—I believe they can. But I call their attention to this fact, that the quantity of carbon bisulphide in the gas is only a mere trace, and that the quantity of oxygen required to burn coal gas is more than coal gas itself; roughly speaking, 100 volumes of coal gas require 130 volumes of oxygen. Then, since the oxygen is one-fifth of the atmosphere, every 100 volumes of coal gas require 640 volumes of air; and, therefore, if you are burning coal gas in a room, and do not wish to be suffocated, you must allow this air to come into the room and the products of combustion to pass out. If you do that—if you supply for every 100 feet of the gas you burn the 640 necessary feet of air—then I say that that air in the room can never become saturated with aqueous vapor, and no sulphuric acid can be produced, except in the manner above described.

Gas Heat for Mechanical Purposes.

By T. J. C.

To the inhabitants of large manufacturing centers, who are perforce obliged to reside in districts whose air conditions are so decidedly the reverse of pleasant that they may with perfect truth and fitness be characterized as disgusting, because of their unwholesomeness and uncleanliness, any positive advance in the application of firing principles to the mechanical arts, whereby the consumption of solid fuel will be sensibly lessened (and more especially when that solid fuel consists of bituminous coal), the substitution of the gas maker's product for that of the miners' contribution will indeed be in the nature of a most welcome boon. This congratulatory nature of things, however, is possibly more eagerly looked forward to in other countries than in our own, taking into due note the more or less great diffusion of anthracite coal veins throughout the States—but still the smoke evil grows apace with us; and soon with the thrifty Yankee, as now with his careful prototype in older lands, the question of economy in manufacturing operations must needs assume the nature of a most weighty, leading consideration. So it has come to pass that the cheaper bituminous product is outpacing its more valuable competitor, and without any attempt at exaggeration some of our towns are pretty nearly already in position to dispute the question of supremacy in the matter of sombre cloudiness with the honorably ancient "smoky hollows" of old England.

All this is of absorbing interest to the gas maker, and opens up a most attractive and lucrative field, replete with profit for inventive genius, which is now being quite actively explored. Already has great progress been made in the development of new uses to which gas may be applied in the harness of the industrial world, and the initial discoveries have been so varied and important as to render us measurably certain that such as have heretofore been reported and successfully employed may be accepted as but the indication of how great is to be the future extent of the gas man's domains.

Outside of the first really important impulse given to the employment of gas to other purposes than that of lighting, pure and simple—*i. e.*, in domestic operations and the furnishing of a reliable substitute for medium and small-sized motor powers—was the impetus afforded by the Smoke Abatement Exhibition held at South Kensington, London, England (formally opened on date of Nov. 30, 1881, closing on the date of Feb. 14, 1882), which was a most complete popular success. Indeed so thoroughly had the matter attracted the attention of the people that the London exhibition was virtually transferred to the manufacturing center of Manchester, in which city it secured a vast amount of public appreciation between the dates of March 17 and May 6th, 1882. The official data of the committees appointed to report on the various appliances exhibited on these occasions have since been published, and it is not necessary to the purport of this short note to make any particular mention of the findings of the various committees, except possibly in so far as they may refer to the exhibits of the Thompson Brothers (Leeds, England), who may truly be said to have been the overturners of long-established practice in the matter of staining, enamelling and annealing of glass; and again who have also initiated another system the principles of which are well calculated to exert just as great a revolution in the art of the gentlemen who out of their abundance are so favorably disposed towards their fellow man that they reckon thirteen as but a dozen—the bakers—as the gas kiln did in the case of the glass worker.

Taking first (although it is really not of so much importance to the American gas maker as is the baker's oven) the Thompson burning-in gas kiln as an evidence of advance in the application of gaseous fuel which has made considerable progress in America, the writer will endeavor to convey an idea of its advantages over the old style of working; but must of necessity furnish an imperfect description owing to the absence of drawings. Probably the best method under the present disadvantageous conditions of such illustration deficiency will be to employ an adaptation of the words of Messrs. Powell, Chance and Harris, conjoint compilers of a technological handbook entitled the *"Principles of Glass Making," which are as follows:

"Thompson's patent gas kiln annealing oven is in every respect greatly to be preferred to the old-fashioned kilns previously described. The fuel employed is the ordinary lighting gas mixed with atmospheric air. Not only is the actual cost of burning, kiln for kiln reduced, but the saving of time is so considerable that a gas kiln can efficiently burn in two hours the same class

*Published by Geo. Bell & Sons, York street, London, 1883.

of work as by the old method would remain ten hours in the kiln. The pressure of the gas from supply main is controlled by proper apparatus. The gas passes to right and left of kiln through pipes suitably placed for proper disposition of fuel supply, and enters kiln through a series of jets piercing kiln sidewalls at center of oven; fourteen of the jets are provided for on each side wall, each jet having a separate tap, so that the gas supply to any particular part of kiln can be accurately regulated, and the heat be increased or diminished at any desired point at the pleasure of the operator. At the points where jets pierce the walls provision is made for the admixture of air with the gas before entering kiln. At top of kiln and running its entire top length is a flue connected with a chimney for creation of necessary air current, easily controlled by suitable dampers conveniently placed. The kiln is constructed of fire brick, and is bound together with angle iron and tie-bolts. The front is fitted with cast iron doors opening outwards, and provided with spy-holes through which the progress of the burning can be observed. At bottom of kiln is laid a railway track on which is moved a cast iron carriage, that can be introduced or removed from kiln with perfect ease and freedom. The base of the carriage acts as the bed of the kiln, and on it are laid the different objects to be roasted or stained. This carriage base divides the kiln interior, and is lined with plaster so as to form a heat retaining bed for the glass material operated upon, and to protect the iron work of the carriage as well." It is usual to operate with duplicate carriages, so that one may be loaded ready to take its position in kiln when the other is withdrawn. The obvious advantage in glass staining by this method is that the work really becomes continuous, thus effecting a great saving in time, to say nothing at all about the wonderful economy in expense for fuel, absence of soot, clinkers, and other decidedly positive annoyances of the old *regime*. The authors above quoted give as their opinion that "the practical working of the Thompson kiln proves its economy, regularity and cleanliness."

The plan of the carriage is not a novel one, as many of the older coal or coke fired kilns were provided with such an arrangement, but these latter were very expensive affairs, the additional item of carriage cover (the goods when placed on carriage bed always had formerly to be encased completely) costing for an averaged sized kiln close on to $400. The certainty with which the heat can be applied, together with the sureness of its after control, had much to do with the rapid success of the scheme in this country, where the matter of closeness in working economy is at present perhaps not so minutely inquired into as in England; although we may truthfully state that this last observation hardly applies to the case of the ordinary consumer of gas as an illuminating agent. This party is quite as precise in his scrutiny, and as profuse in his grumbling with us as is the case with our European brethren.

To show the speed and celerity of the Thompson system for burning-in stained glass, we are enabled to give the following particulars concerning some work recently done in England. A large manufacturing concern which had installed a Thompson kiln about four years ago (probably one of the first that had been built for practical working), received an order for a rather large lot of ornamental glass work intended for the decoration of a railway station hotel. The time allotted for the delivery of the work to the purchasers was quite limited, and its accomplishment in due season was somewhat doubted at first; but the attempt was made with the following results. The size of the kiln was 9 feet by 4 feet inside, consequently giving carriage surface for 36 square feet of space whereon to impose the material to be burned; this kiln was made to do active duty for three successive days on the order given by the hotel proprietors. The duty exacted and accomplished in the three days' working is annexed:

First day—9 kilns fired from 6 A.M. to 9 P.M., or 15 hours firing and cooling.
Second day—8 " " 6 A.M. to 8 P.M., or 14 " " "
Third day—10 " " 8 A.M. to 10 P.M., or 14 " " "

This result shows that one kiln, charged 27 times in a period of 43 hours, produced, as a completed and beautifully fired material, 972 square feet of glass, the duty being obtained with an aggregate gas consumption of 8,640 cubic feet, or an average per kiln charge of 320 cubic feet. It might also be added that not a single piece of the glass treated was either destroyed by breaking or impaired as to value by imperfect burning. The figures given (and they are from an unimpeachable source) amply demonstrate the certainty of operation of the Thompson method, at least when the practice of successive firing is followed. So great is this item that some firings in the above total of 27 were completed within the lapse of 30 minutes from the time the laden carriage was entered until it was withdrawn.

Another important consideration in regard to this firing plan is the almost entire absence of expense in keeping the kiln in order. As before noted, the kiln whose rapidity of operation is reported above was among the earliest of those constructed, and since its erection its owners have not had occasion to expend one cent upon it in the matter of repairs.

After thoroughly considering these things it can easily be understood why the seal of mechanical disfavor should have fallen upon the old-young method of fixing colors on stained glass by fire, and that operators in the industry should bestow their favorable attention to the Thompson plan. Among those who are employing this system of firing in the United States the bare mention of these prominent names is sufficient evidence that the New York city artisan is thoroughly convinced of its utility and worth. The list includes Messrs. Louis Tiffany & Co., the La Farge Decorative Company, Herter Bros., Messrs. J. & R. Lamb, and also Mr. Le Prince and Mr. Giessler.

The concluding article will be devoted to the application of gaseous firing to bakers' ovens.

Coal Tar Colors.

Prof. Lewis M. Norton recently read before the Society of Arts of the Massachusetts Institute of Technology, a paper on the subject of "Coal Tar and the Colors Derived from It." We reprint the following synopsis:

Within the last fifteen years a complete revolution has been wrought in textile coloring, the effects of which are familiar to all of us in the brilliant fabrics in the stores, and the many delicately colored curtains, carpets and ornaments of our homes; and these changes have come, not so much from a change in style or taste, as from the introduction of the wonderful colors derived from coal tar, rendering possible a brilliancy and variety of tone in color not previously to be obtained. Under our protective tariff the most economical production in various manufactures has been seldom the aim; but under close competition the manufacturer is forced to pay more attention to the utilization of so-called waste products. Eighteen years ago coal tar not only possessed no value, but was a source of expense to companies engaged in the manufacture of illuminating gas; while to-day it possesses no inconsiderable market value, and, instead of adding to the cost of gas, it diminishes it. The value given to this waste product is the result, in a large degree, of work conducted in chemical laboratories, at first for purely scientific purposes.

Where coal tar is most perfectly utilized it is either subjected to distillation by the gas company, or sold by it to the coal tar distiller. Its composition is variable, but upon distillation it furnishes numerous valuable hydrocarbon oils, aromatic oxygen compounds, and solid hydrocarbons, and these products form the basis for the artificial color manufacture. The most valuable of these compounds obtained by distillation are benzole, toluol, naphthalene, and anthracene, hydrocarbons and carbolic acid. One hundred pounds furnish about 1.5 pounds of benzole, and the other compounds in variable and somewhat larger quantities. Benzole is the starting point of the aniline color industry, and one pound of benzole represents about 2,200 pounds of coal, since it requires about 3,300 pounds of average English gas coal to furnish 100 pounds of tar. One pound of benzole will furnish about one pound one ounce of aniline red. After all the benzole and volatile products have been distilled from the coal tar, the residue, about fifty per cent. of the original quantity, is used for roofing, for concrete, and for so-called asphalt. The value of the residue is often much greater than that of the original tar.

In 1841 the chemist Zinin showed that aniline was a derivative of benzole; but it was some time after the first aniline colors were made that the chemical structure of benzole was understood. The theory, first advanced by Kekuli, in 1866, in regard to its construction, first made an intelligent manufacture of coal tar colors possible. Although this conception of Kekuli had reference simply to the internal structure of a molecule, and was purely a theoretical view, yet it has given an impulse that during the last twenty years has led to the establishment of immense factories, and given waste products every year a value of millions of dollars.

The first coal tar color brought upon the market was picric acid, introduced as a commercial product in 1855. A year later Perkin introduced a purple called mauveine, and from this dates the introduction of aniline colors. The fact that aniline yielded a highly-colored product of oxidation had been discovered by Runge in 1835, and the first suggestion of its commercial utilization was probably made by him. Following the introduction of mauveine came fuchsine, and in 1860 aniline blue first came upon the market; in 1862 the Nicholson blues and the aldehyde green. Aniline yellow and Hoffman's violet followed in 1863. With the year 1866, however, began the true development of the industry, and since that time almost every year has seen new shades introduced, which, on account of greater cheapness, have replaced those that preceded them.

While the investigation and discovery of these wonderful products have busied the organic laboratories of France, England, Switzerland and Germany, yet to the patient work of the Germans is due by far the greater part of the credit for the establishment of this industry. As offshoots from the laboratories of the universities and technical schools of Germany, are to be considered the manufactories of aniline colors to be found on such a grand scale in that country. There are about thirty-five color factories in Germany, nine in France, three in Belgium, seven in Switzerland, and eight in England. In many of these only one or two colors are made, and nearly

every one has its specialty. One factory in Germany employs 2,200 persons. Closely related to the aniline color industry stands the manufacture of artificial alizarine, also a derivative of coal tar. A good instance of the effect of one industry upon another is the fact that the low price of sugar to-day—due to the large production of beet sugar in Europe—is owing to the introduction of artificial alizarine. The large areas now devoted to the cultivation of the beet were fifteen years ago devoted to the raising of madder, from which alizarine is obtained in small quantities. But the discovery, in 1869, that alizarine could be cheaply obtained from the anthracene of coal tar was the death-blow of the madder industry. The total annual product of aniline colors in the world has at present a value of about $25,000,000, and that of alizarine about half as much; while the total value of coal tar products of all kinds cannot fall far short of $45,000,000 per annum. The main use of all this color, of course, is to color silk, wool and cotton, either in a fabric or before weaving; it is also used for letter paper, inks, etc. Silk fiber is easily colored, requiring no mordant. The color forms a chemical compound with the fiber, and cannot be removed by washing, but is slowly decomposed by light. Some of the aniline colors combine with the woolen fiber in the same way, but the colors are generally not so fast as upon silk; they are also slowly acted upon by light. It is but fair to say, however, that the colors made by anilines on wool or silk resist the light fully as well as those obtained by older methods of dyeing, while the shades far exceed them in magnificence. The coloring of vegetable fibers with aniline is far more difficult. Cotton fiber shows no inclination to form a compound with the dye, and a mordant must be used, the one most universally used being tannin. Many of the colors thus fastened upon cotton show remarkable fastness, both toward light and soap. Anilines fastened on cotton fiber with other mordants are exceedingly fugitive. Almost equal in importance with the textile uses is the use of aniline colors in printing; the great beauty of our modern prints is due to their use, together with alizarine.

In America we have two factories where aniline itself is made, and some others that import a partially manufactured product, and finish the making of the colors. There are three establishments of considerable size in the State of New York, and some other scattered aniline red plants. The main product of these is aniline red, of which enough is made in this country to supply the demand. Besides this, aniline blue for letter paper is made here, but about all the other shades are imported. Imported colors have cost our manufacturers, alizarine included, $5,000,000 per annum. The export of any colored fabric from this country, in which the cost of coloring is a considerable item, is rendered difficult, to say the least. Often coal tar is distilled here, the benzole exported and distilled abroad into aniline salts, which are brought back to this country.

It is only by a thorough development of the color industry among us that our manufacturers of colored textiles can hope to compete for the markets of the world. England already appreciates the mistake she made in allowing Germany to lead in this industry.

Oil and Gas Wells of Pennsylvania.

Mr. T. J. Ricarde Seaver has prepared the following interesting notes on these topics, contributing the same to *Engineering*:

It may interest your readers to have a few facts from this part of the world on the recent important oil discoveries in Butler County, where recently the most prolific oil well in the world began to "gush" at the rate of 150 barrels, or over 6,000 gallons per hour. This and the practical application of natural gas as fuel to the iron and other industries of Pennsylvania, form the almost exclusively engrossing topics of the day in Pittsburg and Oil City. I lately spent a week in visiting many large works and natural gas wells at the close of my long vacation trip to America, and it was my good fortune to wind up a most interesting stay there with a visit to what our American friends term "the biggest gusher in the world."

The fortunate owners of this monster well are the Messrs. Phillips Bros., who bid fair to become millionaires. Their "find" is situated about 2½ miles from Bald Ridge Station, on the Western and Pittsburg Railway, about 35 miles from the latter city. Although Butler County has been producing the best quality of oil hitherto obtained in America, the quantity was nothing remarkable until last month, when the No. 1 well struck the "sand" at 1,650 feet, and 30 feet deeper began to flow at the rate of 120 barrels an hour. This, at that time, was the largest yield ever obtained, and it continues to flow now at about 60 barrels an hour. The No. 2 was well advanced into the sand on October 21st, and at 7 P.M., on that day, at a depth of 1,678 feet, it began to flow so violently that the preparations made for the reception of the oil were with difficulty made to suffice. Within 24 hours 6,000 barrels=252,000 gallons, flowed into the tanks, and was sent on its way to the refinery through the main pipe line to Cleveland, Ohio, 170 miles distant. Two other wells have been drilled into the sand at nearly the same depth, and within a few hundred yards distance, are producing from 100 to 115 barrels per hour each.

These large figures must naturally affect the market, and when the district was first opened up the price fell from 93 cents a barrel to 59½, but is now up to 74 cents (=3s. for 42 gallons). This is, of course, the crude petroleum, and does not include transport, which may be set down at 20 cents a barrel to Cleveland or Lake Erie, and 50 cents to the Atlantic seaboard. The transport is done by a company called the United Pipe Lines, who have enormous storage tanks and pumping stations scattered throughout the oil districts, whence main lines are laid to Cleveland on the one side, and New York and Philadelphia on the other. The total distance covered by their system of pipes must be little short of 1,000 miles, and the total storage capacity over 42,000,000 of barrels, or nearly 1,000 millions of gallons. Their pumping stations are from 15 to 25 miles apart, according to the configuration of the country through which the lines pass. The system of the Pipe Line Company is commercially something like banking; they open an account for each customer, and credit him with the oil delivered to their stations, and debit him with the quantities sold and delivered through their refineries, minus the cost of transport and a small commission.

Through the courtesy of Mr. Vandergrift and Mr. J. J. Buchanan, of Pittsburg, I am enabled to give you an idea of the strata through which the drilling has been done in Butler County. The following is a copy of the foreman drillers' log, taking the sea level as the datum line:

	Thickness of Strata in feet.	Total Depth.	Distance from Datum.
Well mouth above ocean in feet	—	—	1,436
Conductor	—	9	1,427
Slate, alternating with sand shells, bluish	133	142	1,294
Sandstone, dark grey	24	166	1,270
Slate and shales	6	172	1,264
Coal.			
Coal	1	173	1,263
Slate and shale, dark grey	49	222	1,214
Limestone.			
Limestone	—	222	1,214
Slate, dark grey	34	256	1,180
Sandstone, grey	16	272	1,164
Slate, shale, and sandy shells, dark	125	397	1,039
Ferrif. Limestone.			
Slate and sand shells, with some iron pyrites and coal	32	449	987
Sandstone, top white, bottom black, "60-ft. rock"	43	492	944
Slate and shale, bluish grey, black at bottom	45	537	899
Sandstone, greyish white, "20-ft. rock"	18	555	881
Slate and shale shelly, dark	52	607	829
Sandstone: White, "30-ft. rock"; Grey, "20-ft. rock"; White and soft, "50 ft. rock"; " close, "40-ft. "; " soft, "43-ft. " (Mountain sandstone.)	183	790	646
Slate, shale, and sand shells	145	935	501
Sandstone, hard and white	5	940	494
Slate, clean bluish grey	30	970	466
Sandstone, shaly grey	20	990	446
Shale, slaty bluish grey, with a gas vein at 1,190 ft. in a thin shell of fine bluish sandstone	260	1,250	186
Shale, sandy, with a few yellow pebbles, bluish	52	1,302	134
Slate, shaly, purplish	34	1,336	100
Second Sand.			
Sandstone, pebbly, 3 ft.; " grey, 9 ft.; " slaty mixture, 12 ft.; " grey and fine, 12 ft.	36	1,372	64
Slate and shale, dark	38	1,410	26
Sandstone, uniform, hard white, "50-ft. rock"	22	1,432	4
Slate, blue	28	1,460	24
Sandstone, homogeneous, fine white (30-ft. rock)	42	1,502	66
Slate, shelly blue	8	1,510	74
Sandstone, yellowish grey, fine "boulder"	14	1,524	88
Slate, blue	6	1,530	94
Sandstone, grey ("stray 3d")	16	1,546	110

Third Sand.			
Pebbly sandstone..... Sandstone, white..... " grey and hard.....	20	1,566	130
Slate, shaly dark blue.....	40	1,606	170
Fourth Sand.			
Sandstone, dark "clover seed pebble".. " fine white..... " good white pebble.....	25	1,631	195
Oil.			

NOTES.—Drilled dry; cased at 643 ft.; very little salt water below casing; gas at 1,190 ft., half sufficient to fire boiler with while drilling, but gave out in three or four days; about same amount of gas was found in 2d sand; very little oil in 3d sand; the hole filled up with oil to 300 ft. or 400 ft. from top of 4th sand, and flowed when drilled a few feet deeper. No red rock found in drilling; best daily production forty barrels.

The cost of drilling a well differs according to the manner in which it is contracted for. If the driller has to find all tools and deliver the well flowing, he gets about 3 dols.=12s. a foot, and the maximum depth yet reached has been 2,200 feet without finding oil. If, on the other hand, the tools and materials are found for the drillers, it may be done for about half, or 6s. a foot.

Previous to the discovery of such abundant oil wells in Butler County, the great excitement around Pittsburg was (and indeed still is) the boring for "gas wells." The importance attached to these may be gathered from the fact that owing to the recent introduction of natural gas for the boilers and bloom heating furnaces at Carnegie Works, at Bessemer, over 250 men stokers and helpers have been discharged, and the change is so marked by the absence of smoke and incumbrance by coal, etc., and so appreciated by the managers, that it has been decided to apply it to all their furnaces where heretofore coal had been used. Its adoption at these works did not appear to me to be so economically carried out as at others I visited in the city of Pittsburg itself. At Bessemer the pressure was 60 lbs. to the square inch at the nozzles where the gas is introduced under the boilers, and 2 lbs. only at the heating furnaces. This difference is no doubt due to the fact that at the latter there are regenerative chamberz on the Siemens principle, and these had previously existed. But at the boilers the old fire grates, pure and simple, were left, and the gas jets introduced through the old fire doors, with cold air. The gas enters through a ¼ inch aperture, and the pipe is surrounded by a 3 inch tuyere perforated at the sides, through which a current of air passes by natural draught and mixes with the gas in the proportion of about 15 of the former to 1 of the latter.

At two other works I saw a more economical application of natural gas as steam fuel. The pressure indicated by the mercury gauge was not over 6 oz., and the result even more satisfactory than at Bessemer. The gas was led to the front of the boiler in a 3-inch pipe (from a 6-inch main), and from this four ¼-inch pipes were taken at right angles and introduced under the old fire grate level, where the gas mingled with highly heated air derived from a series of flues heated by the waste. This heated air was only allowed to mingle with the gas at the proper point for ignition, and in the proportion suitable for complete combustion.

I also saw it applied to glass melting furnaces and others with the most satisfactory results. The prices charged for the gas, which is a light car burretted hydrogen, or marsh gas, is 30 cents, or 1s. 3d. per 1,000 cubic feet; and at this rate I was assured a very great economy over coal would be realized. It is now brought to the city by pipes 8-in. and 6-in. in diameter, of wrought iron, ¼-in. thick, lap-welded with screw joints; the thread is slightly beveled, and the pipes are tested up to 500 lbs. bursting pressure. These are laid about 3 ft. deep in the streets, and some extend from a distance of 18 miles. The pressure at the wells varies from 210 lbs. to 100 lbs. to the square inch, and it is calculated that a loss of 4 lbs. per mile is due to friction.

Within a short time it is expected that this gas will be exclusively used as fuel in the great majority of works in and around Pittsburg, and, to a great extent, for domestic heating, so soon as the municipal authorities shall have authorized its introduction to the heart of the city, under such restrictions and regulations as to pressure and distribution as will guarantee the public against accident. The pipes are being laid down all over the place, and the utmost activity reigns amongst the rival companies who have secured rights; and more important still, a good supply from their wells. For domestic uses it is proposed to charge 5s. per 1,000 cubic feet, 20 per cent. dearer than ordinary illuminating gas, but the caloric power of the well gas is far more intense. For illuminating purposes it is not suitable in its natural condition, but by passing it through heavy hydrocarbon oils (such as heavy petroleum) in a very fine state of division, to avoid clogging up the pipes, it would be superior in candle power to the ordinary coal gas.

Although the question of utilizing natural gas as fuel can have but a meagre interest for our English manufacturers, it may become of the highest importance to some Continental countries. In Asiatic Russia the supply is practically inexhaustible. The "eternal fires" of Baku on the Caspian may soon be devoted to the more useful and practical purposes of iron and steel manufacture than that which for centuries and ages they have served—as emblems of worship for Oriental fanatics. In Transylvania and in Italy it is found in considerable abundance. Still nearer home, in France, near Grenoble, I am credibly informed a most important well exists, which, according to well-authenticated records, has been flaming since the time of Julius Cæsar. This is well known as the "*Fontaine Ardente*" of the Gauls, and it is only within the last few months that an able French engineer, who had previously visited America, has commenced works there with the object of utilizing the gas for industrial purposes. He was drilling on the spot when I left Europe last September, and I presume ere this will have augmented the supply, and probably have discovered either coal or petroleum, or perhaps both, to reward him for his spirit of enterprise and conviction.

As regards its qualities as a fuel for open-hearth steel making, I can scarcely give you a better proof of its excellence than the fact that at Pittsburg a well-known maker has been using it for some time with this result—that, notwithstanding it costs him 4s. 7½d. to produce with natural gas that which he formerly did with other fuel at an expenditure of only 2s., he declares the product to be so superior in quality as to warrant his continuing and adapting his entire plant permanently to the use of this fuel.

At Bradford, Franklin, and Oil City the use of natural gas has now become almost exclusive, and the only thing left to be desired and hoped for is that the supply may never grow less.

Condensing Sulphuric Acid Gas.

An English contemporary notes that an ingenious, though somewhat complicated, apparatus for the condensation of sulphuric acid gas has been introduced at Roszdin, in Silesia, and found to work very satisfactorily. The sulphurous gases from the calcining furnaces are taken to a lead-lined tower packed with coke, flints, or any other suitable material in the usual manner, down which water trickles from a cistern on top of the tower; the water absorbs the sulphurous acid gas, and also the sulphuric acid and soluble sulphates that may be carried over from the calciner. It then flows out of the bottom of the tower, and is taken through a lead pipe to a series of closed shallow lead pans, a dozen in number, arranged one above the other in a fire brick chamber, through which pass the hot gases from the calciners on their way to the condensing tower. The lead pans communicate with each other by lead pipes, placed in diagonally opposite corners, and arranged so that the liquor is taken out from the top of each pan, and flows into the bottom of the pan below it. The hot gases passing around and between the pans cause the liquor to leave the lowest pan at considerable heat. This hot liquor then rises through another lead pipe to the top of a smaller tower, of cylindrical shape, and lined with lead, in the center of which revolves a shaft covered with lead, and having several discs of lead attached to it. These discs, revolving on the shaft, alternate with fixed ledges or shelves on the sides of the tower, and as the liquor flows down in a cascade over these ledges and discs it is broken up into very fine spray. At the same time a current of hot air is passing up the tower, and takes up and carries away the sulphurous acid gas that is liberated from the hot spray. It is drawn off from the top of the tower and led away to a sulphuric acid chamber, or other point at which it may be desired to further operate with the sulphurous acid. The hot liquors that have thus been freed from the sulphurous acid taken up in the condensation tower flow into a long closed cistern of lead, through which pass a large number of lead tubes arranged like a surface condenser. The air that is to pass into the spray tower is first forced through these tubes, which are surrounded by the hot liquor, and is in this way warmed. The apparatus is so made that the pipes expose sufficient surface to completely cool down the liquor, which then leaves the cistern and is pumped up to the top of the condensation tower to again absorb sulphurous acid, etc., and perform the same round. The warm air from the lead tubes is taken through heaters, which are exposed to the hot gases coming from the calciners, and, being thus made quite hot, passes into the spray tower as described. By continually circulating in this manner, the liquor finally takes up a considerable amount of sulphuric acid and soluble sulphates, and when sufficiently concentrated a portion is drawn off and evaporated down in lead pans, a corresponding quantity of fresh water being added in the condensation tower.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

YONKERS (N. Y.) GAS LIGHT COMPANY REDUCES PRICE OF GAS.—Mr. James D. McIntyre, Secretary of the Yonkers Gas Light Company, forwards us the news, under January 7, that his company has had, despite the adverse circumstances attending the year's working, enough of prosperity to enable it to declare a semi-annual dividend of 3 per cent. on the capital stock, made payable on and after date of February 1. The managers of the corporation have also seen fit to make a decided reduction in the price of gas to consumers, the reduction to take effect on consumption registered on and

after January 1, 1885. The new schedule is as follows: To those using less than 10,000 cubic feet per month, $1.50 per thousand; upward of that quantity, a further deduction of 10 cents per thousand will be allowed.

Gas affairs at Yonkers have been in a pretty badly mixed condition for the period of almost ten years; and all because of the readiness with which opposition charters were granted. The place is undoubtedly a thriving, flourishing one, and besides possessing quite an extensive collection of briskly active manufacturing establishments, is fast becoming peopled with a thoroughly substantial class of business men, representing the best grades of the merchant and professional orders of New York city, who find it at once pleasant and economical to locate their homes in the handsome town on the east bank of the Hudson, rather than at a lavish outlay be obliged to coop their families up in the narrow limits of the average Metropolitan homestead. But aside from this aspect of the growth of Yonkers the multiplication of gas companies there has quite decidedly outpaced the gas consuming needs of the people; and in this particular it is but like unto many of its neighbors. A correspondent, who is thoroughly conversant in the history of the Yonkers opposition, has most kindly furnished us with some interesting details regarding the same; and our informant's knowledge of the case is contained in the following:

"The Yonkers Gas Light Company has had to contend with the raiders for about ten years past, and the old corporation is intimately conversant with their peculiar methods. The first attack came with the appearance of the Westchester Gas Light Company, the operators of which, after having sunk a sum amounting to $185,000, made a proposition to sell out to the old company, naming as an appropriate figure for the transfer the item of $50,000. This proposition was refused; but the managers of the Yonkers Company did enter into negotiations which resulted in a settlement, for the time being, of active hostilities. The basis of the truce was a division of district, with ceding of mains on both sides, the Yonkers Company to make all the gas for the territory, supplying the Westchester holders with whatever quantity of gas was demanded on account of its consumption, and to charge a stipulated price (a very low one it was) for such supply, etc. This arrangement worked very well for the space of a year, when the spirit of peace was rudely disturbed by the advent of opposition No. 2, yclept the Municipal. The Westchester branch of the year-old combination became alarmed to such a degree that its presiding genius urged that the Yonkers Company head off the opposition by purchasing and employing the Lowe water gas system. This the latter refused to consent to; and the Westchester parties put in the water gas plant, and determined to operate once more on their own account. They seized hold of the mains as originally put down by them and began to supply gas indiscriminately. When the Westchester company went outside of the stipulated boundary the old company took possession of the mains ceded by them at time of truce agreement; and the joke of the thing was that the best portion of the Westchester's consumption happened to be along these particular conduits. With recovering the particular lines of pipes, as a necessity the consumers were gotten hold of also; and the Westchester Company, failing to appreciate the humor of the situation, entered suit against the Yonkers, claiming damages in the sum of $100,000. The suit was decided adversely to complainants, and it cost them some $1,700 before they were well clear of their ill-advised law proceedings. After that fiasco the whole matter settled down into the nature of a pretty triangular contest, and the imbroglio, after the lapse of five or six years, still keeps on. Its progress puts me in mind of the articles published in the JOURNAL during the month of January, 1884, descriptive of the old-time London gas competition period; but of course the Yonkers matter but bears the same ratio to the London period only as the flame of a tallow-dip compares with one of the new high-power burners.

"The companies are not slow at canvassing for consumers, and the consequence is that the householders are constantly altering their allegiance by continual change in the bestowal of their favors, now going to one company and then to a rival; the streets are torn up in all directions; the leakages of gas may be noted in abundance, and the public can get no remedy from the stench—it is a fact that many houses and stores are rendered almost uninhabitable from this circumstance—since each company claims, when appealed to, that the leak emanates not from its conduits, and consequently refuses to make search for the seat of the trouble. So it goes; continually going on from bad to worse. During the early period of the struggle there was apparently a sort of tacit understanding that a schedule of prices varying, according to consumption quantities, between $1.25 and $2 per thousand would be adhered to. In the latter end of December the old company ascertained that although the two other competitors were charging their own customers $2, they were slyly trying to take customers away from the former by offering to supply them at $1.50. This knowledge precipitated open warfare, the Yonkers Company advertised a general rate of $1.50, and the newer concerns came down to $1.25, which are the present (Jan. 7) ruling rates. Neither branch of the opposition ever paid a dividend, although the Yonkers Company manages to make a pretty regular return to its shareholders. The Westchester is now run by a Receiver, and is engaged in defending a suit brought by Mr. W. Astor to recover $50,000 and interest, now pending decision in Court of Appeals, the lower courts having decided adversely to defendants' standing in the case. How or when the fight will terminate no one can tell; but in the meantime the consumers are getting supplied with good gas at a low figure; still they will require a great expenditure of pity for their future plight if consolidation takes place. They may have the doubtful pleasure of paying good interest on three sets of capital."

AN INTERESTING NOTE FROM EAST CHESTER COMPANY, OF MT. VERNON, N. Y.—Mr. Charles Nettleton, whose valuable services to the fraternity of this country are so generally recognized and remembered in connection with his performance of the duties of the Secretaryship of the American Gas Light Association when that organization was not in the flourishing condition now so happily and completely attained by it, is still the guiding spirit in charge of affairs of the East Chester Gas Light Company, and, as its President, is thoroughly alive to the importance of keeping its helm in the right direction. The gentleman has empowered us to state that selling rates have been reduced in accordance with the annexed schedule, to take effect from first day of March next:

	New Rate.	Old Rate.
A monthly consumption of over 500 cubic feet...	$2.00	$2.50
A " " below 500 " ...	3.00	3.50

This virtually amounts to an all-round price of $2 per thousand, and is a very low figure when due note is made of the situation. Mr. Nettleton has determined to make considerable extension to the producing capacity of the East Chester plant, and the alterations and additions, among other items, include the erection of four benches of sixes, which are to be fired under the improved Stedman principle. The total expenditure necessary to complete the proposed changes will be between thirty and thirty-five thousand dollars. Brother Nettleton means to "keep the rascals out."

ANOTHER VICTIM.—It is a pity that when the "deal" was fixed up in Baltimore, Md., some sort of a provident fund was not arranged for looking to the suitable burial of those victims who are reported to have "blown out the gas" manufactured and sold there. A despatch received from that city, on date of Jan. 8th, says: "Wm. Bergman went to his home at a late hour last night, and when retiring blew out the gas. He was found dead in bed to-day" Following out the fund idea mentioned above, perhaps a fund has existence for the purchase of suitable tombstones wherewith to decorate the resting-place of the "blown-out" dead, in order that Baltimore, at least as to its graveyards, may rightfully retain the tall title of the "Monumental City."

COKE FUEL CONSUMPTION AND RAILROADS.—It is asserted that the Pennsylvania Railroad Company's engineers are devoting some attention to the value of *crushed* coke as a fuel. The experiments at present are being confined to steam raising in yard locomotives; but it is the ultimate purpose to employ it in the furnaces of passenger and freight engines of the road should the preliminary trials warrant the step. Our present information is that the project is likely to prove successful.

A NOVEL WAY OF CATCHING A THIEF.—A leading druggist's publication of this city says that on a recent feast day at Cotopaxi, Mexico, the leader of a band of thieves in that section concocted a scheme for a large haul of plunder by extinguishing the electric light in the cathedral. He used a small wire which, in his ignorance, he threw over the exposed wires carrying the electric lighting current, and the same, passing through his body, killed him instantly. His confederates were appalled at the sudden death of their leader and fled, escaping capture.

CHEAPER GAS FOR TOPEKA, KANSAS.—Mr. J. T. Clark, Secretary of the Excelsior Coke and Gas Company, of Topeka, forwards us the information that on November 1st, 1884, his board of directors determined to make a reduction in selling rates in continuation of the policy that has always marked the management of the company. The prices ruling since November 1st are as follows:

A monthly consumption of 8,000 cubic feet and over,	$2.50 per 1,000
" " below 8,000 "	2.70 "

The new schedule is made operative only in regard to such accounts as are settled on or before the tenth day of each month. Consumers neglecting to settle within the prescribed time will be charged at the former rate of $3.00 per thousand. The last reduction, if we remember rightly, is the fifth one granted since the Topeka works went into operation. The efficiency of the plant has been kept at a high standard by taking advantage of improved methods and machinery; indeed the Excelsior plant has, it might as well be claimed, been entirely rebuilt within the past two years. Messrs. Holliday and Clark justly pride themselves on the fact that the lowering of sell-

ing rates has always been made without solicitation on the part of the consumers, and in accordance with the idea that the inhabitants of a city are entitled to a good round percentage of the prosperity which their increase in numbers and wealth affords to a corporation operating amongst them. How much better and safer this course is to the stockholders of the Excelsior Company than if its managers, in the flood-tide of present success, were to call in the services of the financial watering-pot. This last is the sort of flood-tide proceeding that enables the wreckers oftentimes to "make a port." To the dismay of the privateering gentry, as they increase and multiply (some six or eight different "construction companies"—destruction would more truthfully define them—have been formed in the last quarter) in numbers, the eligible landing-places appear to "grow beautifully small and elegantly less." Low selling rates have blockaded the passages; and fair treatment of consumers operates as a dangerously destructive torpedo boat to securing free wind and fair sailing by the buccaneers carrying the opposition flag.

Electric Light Plant Injured by Lightning Strokes at Houston, Texas.—A queer circumstance is reported from Houston, Texas, where the climatic conditions during the latter part of December and the early portion of present month were marked by the occurrence of unusual and wonderfully intense and protracted electric storms. Nature's dynamos seem to resent the appearance of the artificial ones in Houston, and it may be possibly accounted for on the score that this is but another feature of what may be accomplished through the agency of the "glorious climate" of the Lone Star State. The Houston *Chronicle*, of date Dec. 31, in detailing the storms, and referring particularly to one of night previous, said: "The lightning prostrated several electric light poles in the First, Fourth and Fifth wards, smashing lamps and globes. At the electric light works the lightning played havoc with the plant, burning three dynamos out in two nights. Two extra or reserve machines were also struck by lightning, putting out every arc light in the city. As a consequence extra dynamos have been ordered from New York, to be shipped here by express; but as it will take at least three days before they can arrive, Houston's 'pale moons' will be temporarily eclipsed. The actual damage to the electric lighting apparatus will reach up into the hundreds, to say nothing of the loss occasioned by temporary interruption of service." With even Nature's most potent artillery directed against them, and taking into account the present attitude of Houston's City Council with reference to the lighting contract, the lot of the Houston Electric Lighting Company appears to be a most unhappy one.

A Trifling Difference in the Figures.—We all know that the promises of the electric lighting promoters require to be "taken" with a grain of salt—not meaning that the chloride of sodium grain is necessary to keep the promises in a state of freedom from decay (for there is a certain everlasting freshness about their pledges warranted to keep them clear of the corroding influence of the combined ravages of atmospheric effect and lapse of season), but rather that the pledges may be the more easily assimilated. A certain Mr. Curtis, representing the Thompson-Houston Electric Light Company, of Boston, Mass., has been trying to convince the Common Council of Poughkeepsie, N. Y., that arc lighting would be a "good thing" for the taxpayers of that city, and so he has been offering the City Fathers an "option" on the purchase of sufficient plant wherewith to do the requisite lighting of the city's streets. Mr. Curtis does not appear particularly anxious to erect a plant on his own or his company's account, and perhaps this plan has been found a little too unlike a "good thing." However, in his proposal to the Council, Mr. Curtis submitted a detailed statement as to what outlay would be required on the part of the municipality to establish an electric lighting system that might be counted on as equal to street lighting needs there. He figured it out an investment of $30,300 (mind the delicate preciseness of the "$300") would equip a "six-mile-of-wire" plant and furnish everything requisite for the running of 100 lamps. Mr. A. L. Allen, of the Citizens' Gas Company, could not bring himself into that requisite digestive condition in which any amount of salt would enable him to complete the process of deglutition. The Citizens' Company does the street lighting in the city, and up to Dec. 31 we believe it had 623 street lamps to supply, on a total main length of 23.5 miles, and the price received therefor for the twelvemonth was $19,932. Mr. Allen accordingly went into a calculation as to what amount of money would be really necessary so that the municipality might be placed in thorough position to operate an electric plant that would take the place of the present gas street lighting system. Taking as the basis of his calculation the figures furnished by Mr. Curtis, Mr. Allen was not long in piling up a needed first investment of $100,000; and he did not exaggerate the case in a single instance. At 6 per cent. per annum here would be a charge of $6,000 to start with, or about 31 per cent. of the total sum paid to Citizens' Company for doing the street lighting in 1884. No doubt if Mr. Curtis got the job through he would obtain a "good" commission on the transaction, the Boston Electric Company would have a "good" profit on the first "lot" of plant agreed to be delivered, and have a right "good thing" in prospect resembling future orders for a "goodly" quantity of additional electric "goods" needed by Poughkeepsie to make the "outlying" streets leading off from Main street share in the "arc" illumination. We hardly think Mr. Curtis' figures are sufficiently voluminous to convince even a Poughkeepsie Councilman that they are hardly "good" enough to hold water.

An Explosion at the Augusta (Ga.) Gas Works.—Brother George S. Hookey, Manager of the Augusta (Ga.) Gas Works, has been "enjoying" a shake up; but the "Crackers" never attach much importance to a shake up, and certainly old Philadelphians (particularly the celebrated members of the heroic band of "Snappers") will be ever ready to give Geo. S. the credit of always being in the front rank when a shaking up was in process. Still, the rumpus that occured at Augusta, on Monday, Dec. 29, cannot have been to his liking; and indeed it was fortunate that the matter turned out no worse than the record shows. At about 8 o'clock on the morning noted some workmen were engaged in connecting the inlet pipe of a recently completed gasholder (capacity 130,000 cubic feet) to outlet from station meter. Something or another displaced the bladder cap, and, quicker almost than it takes to narrate it, an explosion occurred that tumbled down the upper story of the meter house, and made a sad wreck of the meter. The two workmen on the job were more or less injured, but neither fatally. Steps were immediately taken to shut off the flow to the wrecked building, and there was no stoppage of supply to consumers. The damage amounted to about $5,000. To show what a narrow escape "Snapper" George had, it is only just necessary to mention that not five minutes before the explosion occurred he left his office (in second story of meter house) to visit another part of the works. We had almost forgotten to state that a gentleman named Pendleton, one of the contractors doing the holder work, received a severe shock during the outbreak, but luckily escaped fatal wounds. It may be news to the Southern fraternity that the Hon. George T. Barnes was recently elected to the Presidency of the Augusta Company.

Personal.—Mr. Jas. G. Miller, of the Green Bay (Wis.) Gas Light Company, reports business as "booming" there. The gentleman has been connected with this company since his original construction of its plant in 1870, and for some time back has been in active charge of affairs.

Another Mysterious Pilgrimage Case, with the Reason Therefor.—Littleton's example probably led Ramsdell astray, and Ramsdell's "Eastern" journey last June has had a demoralizing effect upon Ben. Perkins, of South Bend, Ind. It was rumored of late that Ben. had a wonderfully large number of "pressing" business engagements at Indianapolis (who doubts the pressing urgency of them now?) But it is rather strange he should say Indianapolis when he meant to utter Columbus. Preoccupation is undoubtedly thus betrayed; yet Ben. knows best, and we all know now why his objective point was the latter place rather than the former. We are sorry to unmask his deceit (or rather his preoccupancy), and make plain to the brethren of the Hoosier State why it was thus. On the evening of Friday, Dec. 26, the culprit led to the foot of Hymen's altar a most willing captive in the charming person of Miss Ida Adams, a popular belle in social circles of Columbus, Ind. The Rev. G. J. S. Browne completed the sacrafice by joining the twain together according to prescribed form; and the gallant Ben. has since been heard to say that not a gas man in the West was half so well treated by old "St. Nick's" disposition of Christmas favors for 1884 than was his honorable self. No more than his usual luck, and may it follow him and his other half.

The Gate City Gas Company Increases the Atlanta (Ga.) Death Roll.—A guest at Mercer's European Hotel, at Atlanta (Ga.), lost his life through being suffocated by the inhalation of water gas on the night of Dec. 25th. When body of deceased was discovered it was noticed that the burner cock had been partially turned off, and from that circumstance it is conjectured the victim was in the habit of sleeping in a partly illuminated apartment. Water gas, on account of its great density, and its tendency to stratify under certain favoring conditions, makes a most dangerous sort of unattended night-light. Name of deceased is reported as "Brantley;" and he was not known as a resident of Atlanta. The case has attracted considerable attention there, as it naturally would when it is remembered that not a single fatal case of asphyxiation is chargeable to the old Atlanta Gas Company during its thirty years of distribution.

An Explosion of Gas at North Adams, Mass.—A slight explosion of gas occurred in the town of North Adams on morning of Tuesday, Jan. 6th. A plumber hunting for an escape of gas with a lighted match was the cause of the trouble. For the first time on record in like cases we are happy to say that the only one injured was the plumber; but in accordance with history again, the only damage done unto him was the loss of a mustache! We hope he valued it highly.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—JOS. R. THOMAS, C.E
Manager—C. E. SANDERSON.

PUBLISHED ON THE 2ND AND 16TH OF EACH MONTH
At No. 42 Pine Street, New York.

This is a recognized official organ of—
LIGHT, HEAT, STEAM, WATER-SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE.

TERMS
SUBSCRIPTION—Three Dollars per annum, in advance.

AGENTS
NEW YORK—AMERICAN NEWS CO. 39 and 41 Chambers St.
BOSTON—S. M. PETTENGILL & CO., 6 State Street.
PHILADELPHIA—PRATT & CO., Corner 9th and Arch Streets.
England—C. W. HASTINGS, 72 Buckingham St., London, W.C.
Germany—B. WESTERMANN & CO., of New York

FRIDAY, JANUARY 16, 1885.

A New York Victim.

A man named A. P. Bloomfield lost his life on date Dec. 31st, '84, in Ashland House, New York city, through inhalation of illuminating gas. On retiring to bed he failed to note that the burner stopcock was loose, and in consequence unwittingly turned the current on after once putting out the flame. Bloomfield was formerly cashier of the aristocratic Knickerbocker Club, and latterly superintendent of the Pelham Club, whose race-course, etc., is located at Bartow-on-the-Sound. Life was not entirely extinct before discovery of his condition was made, but prompt medical aid failed to restore him.

This One a Suicide.

A German named Moritz Orbach committed suicide on night of Jan. 3d, in his apartments at No. 100 East Fourth street, New York city. He had closed up every crevice through which the gas might escape, turned on the current, and threw himself on his bed. His destitute condition is assigned as the reason why he killed himself. He left a letter to his landlady explaining his circumstances, and how he proposed to end his life.

The Plumber Once More.

Einstein, Hirsh & Co., importers of laces, etc., formerly did business on upper floor of premises 86 and 88 Franklin street, New York city, but decided to remove their location. On Saturday, Jan. 3d, the stock (usually reaching in value to half a million dollars) had been nearly all transferred to the new headquarters, the quantity remaining behind on that date being worth about $40,000. A plumber had been authorized to remove the gas fixtures on the afternoon of that day. It was late when he got through the job, and he rather hurried matters at the finish. So great was his hurry that he failed to cap one of the bracket connections, and the gas escaped all night Saturday, the following Sunday, and up to 9 A.M. of Monday morning. When Einstein's folks visited the place on the 5th they found the rooms permeated with gas, and the "mechanic" was instantly summoned to find the leak. This he did on his prompt arrival by vigorously waving a lighted candle. Immediate result—explosion, fire, two fire alarms. Subsequent reckoning—loss by explosion, fire and water, $68,000.

Gas-Heated Assaying Furnace.

The United States Mint exhibit at the New Orleans (La.) International Exhibition naturally attracts much attention. One of the most interesting features connected thereto (at least to the gas man) is the application of gas heat to the assaying furnace devised by Messrs. Reichhelm & Koester, of New York city. The air supply is furnished through the medium of a "Root Blower."

CONTRACT AWARDED.—The Indianapolis (Ind.) Gas Light Company has just awarded a contract to the Kerr-Murray Manufacturing Company for the erection of a set of sixteen feet purifier boxes, sixteen-inch centerseal and connections, with hydraulic lifts for raising purifier covers.

The Market for Gas Securities.

The city gas share market during the fortnight ended Jan. 14th has been inclined to show a decided downward tendency as to quotations. The only securities on city list proper which have fairly maintained prices ruling at close of year are Equitable and Harlem. The former is very stiffly held at 96, a bid of 95½ having failed to bring out a *bona-fide* transfer. Holders of Equitable, and more particularly those heavily loaded up, talk most confidently of the future prospects of the corporation; and it is rather amazing to hear some of their prognostications in regard to all the trouble they will hereafter cause the managers of the Consolidated Company. In the hereafter it will be, and a drearily long one at that. The likelihood is that the Equitable folks are "whistling to keep their courage up," and President Graham is no amateur in the delicate art of portraying rosy colors on the many financial canvases which he has so often deftly unrolled. The one great trouble, though, with the majority of brilliant colors is that exposure to the sun somewhat detracts from their stability, and we fear that were the sun of close investigation applied to the rather reckless assertions of the sanguine Equitable manipulators the airiness of the fabrics would be made apparent. Consolidated stock is weak and lower; and although the emission of the new certificates is as yet delayed, quite a little business has been transacted in contracts for future delivery. Sales have been made at as low a figure as 80, and the offerings at 81 are plentiful. The futures already disposed of generally cover smaller lots than 50 shares; and we know of several orders now in hand in which the buyers' directions are to purchase at "better than 80." Although the market for this security has gone against our predictions, we still adhere to the original claim that at 85 or below Consolidated is a purchase. It is now said that the new certificates will be ready for delivery by date of February 1st. This, however, is mere guesswork, and the truth of the case is that only the managers of the Consolidated Corporation know when the new shares will make their appearance. The Mutual Company paid a regular quarterly dividend of 2½ per cent. on Jan. 10th. Wednesday, Jan. 7th, 200 Manhattan, at auction, at 248.

Brooklyn (N. Y.) shares are dull. Williamsburgh Company declared a regular quarterly dividend of 2½ per cent., payable 21st. Fulton Municipal paid a regular quarterly dividend of 3 per cent. on Jan. 15th. Mr. Joseph R. Thomas has conveyed to a syndicate of New York city capitalists (largely interested in real estate in the vicinity of Long Branch) a controlling interest in the capital stock of the Long Branch (N. J.) Gas Light Company. With this closing out of his interest Mr. Thomas retires from the Presidency of the Company—a position which was acceptably filled by him during the last eleven years. For quotations see below.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks (with A. E. SCOTT & CO.,)
72 BROADWAY, NEW YORK CITY.

JAN. 16.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Central	$440,000	50	60	—
" Scrip	220,000	—	47	57
Equitable	2,000,000	100	94	96
Harlem	2,000,000	50	114	118
" Bonds	170,000		—	—
Manhattan	4,000,000	50	240	250
Metropolitan	2,500,000	100	210	220x
" Bonds	658,000	—	110	112
Mutual	3,500,000	100	117	120
" Bonds	1,500,000	1000	104	106
Municipal	3,000,000	100	195	200
" Bonds	750,000		107	110
New York	4,000,000	100	148	151
Northern	125,000	50	—	80
" Scrip	108,000			
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	127	130
Citizens	1,200,000	20	87	90
" S. F. Bonds	320,000	1000	106	110
Fulton Municipal	3,000,000	100	148	150x
" Bonds	300,000		104	108
Peoples	1,000,000	10	78	80
" Bonds	290,000	—	105	110
" "	250,000	—	90	95
Metropolitan	1,000,000	100	90	93
Nassau	1,000,000	25	118	121
" Ctfs	700,000	1000	88	91
Williamsburgh	1,000,000	50	137	140
" Bonds	1,000,000	—	106	108
Richmond Co., S. I.	300,000	50	64	75
" Bonds	40,000	—	—	—
Out of Town Gas Companies.				
Buffalo Mutual, N. Y.	750,000	100	80	85
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	103	115
" " Bonds.	124,000	—	105	110
Chicago Gas Co., Ills	5,000,0000	25	125	—
Peoples G. L. & C. Co., Chicago, Ills			8	12
Cincinnati G. & C. Co.			180	182
Consolidated, Balt.	6,000,000		85	85½
" Bonds	3,600,000		110	111½
Central, S. F., Cal.			—	60
Capital, Sacramento, Cal.			55½	—
Hartford, Conn	750,000	25	122	128
Jersey City	750,000	20	130	140
Laclede, St. Louis, Mo.	1,600,000	100	88	—
Louisville, Ky.	1,500,000	50	95	100
Montreal, Canada	2,000,000	100	181	182½
New Haven, Conn		25	166	170
Oakland, Cal			29	30
Peoples, Jersey City		—	—	75
" " Bonds			—	—
Paterson, N. J		25	96	99
Rochester, N. Y		50	75	80
Washington, D. C	2,000,000	20	190	195
Wilmington, Del		50	188	—
Yonkers		50	90	92
St. Louis, Missouri	600,000	50	340	—
San Francisco Gas Co. San Francisco, Cal.			57½	58

Advertisers Index.

Page

GAS ENGINEERS.

Jos. R. Thomas, New York City 50
Wm. Henry White, New York City 49

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd, New York City 51
T. F. Rowland, Greenpoint, L. I. 51
Delly & Fowler, Phila., Pa. 51
Kerr Murray Mfg. Co., Fort Wayne, Ind. 51
Stacey Mfg. Co., Cincinnati, Ohio 51
Bartlett, Hayward & Co., Baltimore, Md. 51
Morris, Tasker & Co., Limited, Phila., Pa. 50
Davis & Farnum Mfg. Co., Waltham, Mass. 18
Tanner & Delaney Engine Co, Richmond, Va. 43
R. D. Wood & Co., Phila., Pa. 44

GAS AND WATER PIPES.

A. H. McNeal, Burlington, N. J. 50
Gloucester Iron Works, Phila., Pa. 50
Warren Foundry and Machine Co., Phillipsburgh, N. J. 50
Mellert Foundry and Machine Co., Reading, Pa. 50
Cincinnati and Newport Iron and Pipe Co., Newport, Ky .. 50

SCRUBBERS AND CONDENSERS.

G. Shepard Page, New York City 46

REGENERATOR FURNACES.

Charles F. Dieterich, Baltimore, Md. 46

RETORTS AND FIRE BRICK.

J. H. Gautier & Co., Jersey City, N. J. 48
B. Kreischer & Sons, New York City 48
Adam Weber, New York City 48
Laclede Fire Brick Works, St. Louis, Mo. 48
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y. 48
Borgner & O'Brien, Phila., Pa. 48
William Gardner & Son, Pittsburgh, Pa. 48
Henry Maurer, New York City 48
Chicago Retort and Fire Brick Works, Chicago, Ills. 48
Baltimore Retort and Fire Brick Co., Baltimore, Md. 48
Standard Gas Retort and Fire Brick Co., Ironton, Ohio 48
Oakhill Gas Retort and Fire Brick Co., St. Louis, Mo. 48

GAS STOVES.

American Meter Co., New York and Philadelphia 47
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa. .. 28

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y. 50
McNab & Harlin Mf'g Co., New York City 46
John McLean, New York City 44

GAS METERS.

Harris, Griffin & Co., Phila., Pa 54
American Meter Co., New York and Philadelphia 55
The Goodwin Gas Stove and Meter Co., Phila. Pa. 55
Helme & McIlhenny, Phila., Pa. 55
Maryland Meter and Mfg. Co., Baltimore, Md. 54
D. McDonald & Co. Albany, N. Y. 55
Nathaniel Tufts, Boston, Mass. 54

EXHAUSTERS.

P. H. & F. M. Roots, Connersville, Ind. 45
Smith & Sayre Manufacturing Co., New York City 52
Wilbraham Bros., Philadelphia, Pa. 52

GAS COALS.

Penn Gas Coal Co., Phila., Pa. 53
Perkins & Co., New York City 52
Newburgh Orrel Coal Co., Baltimore Md 53
Despard Coal Co., Baltimore, Md. 53
Chesapeake and Ohio R.R. Coal Agency, N. Y. City 53
Westmoreland Coal Company, Phila., Pa. 53

GAS ENGINES.

Schleicher, Schumm & Co. Phila., Pa. 56
Continental Gas Engine Co. New York City. 44

GAS LAMPS.

Siemens Regenerative Gas Lamp Co., Philadelphia, Pa. 49
G. Shepard Page, New York City 53

GAS KILNS AND OVENS.

Thompson Gas Kiln and Oven Co., New York City 44

PURIFIER SCREENS.

John Cabot, Lawrence, Mass. 44

STREET LAMPS.

J. G. Miner, Morrisania, New York City 45
Bartlett Street Lamp Mf'g Co., New York City 45
Geo. D. Winchell Mf'g Co., Cincinnati, Ohio 45

BURNERS.

G. Gefroerer, Phila., Pa. 50
Walter Anderson, New York City 50

PURIFYING MATERIAL.

Connelly & Co., New York City 45

STEAM BLOWER FOR BURNING BREESE.

H. E. Parson, New York City 18

PIPE COVERINGS.

Chalmers-Spence Company, N. Y. City 43

GAS FIXTURES.

Mitchell, Vance & Co., New York City 48

STEAM ENGINES.

Westinghouse Machine Co., Pittsburgh, Pa. 53

STEAM PUMPS.

A. S. Cameron Steam Pump Works, N. Y. City 45

PIPE CUTTING MACHINE.

Pancoast & Maule, Philadelphia, Pa. 44

HYDRAULIC ELEVATOR.

Lane & Bodley Company, Cincinnati, Ohio 45

SHAFTING, PULLEYS, ETC.

A. & F. Brown, New York City 43

BOOKS.

The Chemist's Assistant 44
King's Treatise 46
Scientific Books 54
Fodell's Book-Keeping 46
Management of Small Gas Works 46
Newbigging's Gas Manager's Handbook 48

WANTED,

A Manager Capable of Taking Charge of a Small Works.

Address, giving references and salary required,

HELENA GAS LIGHT AND COKE CO.,
614-2t HELENA, MONTANA.

Situation Wanted

As Superintendent of Gas Works, or Position with some Constructing Co.,

By a reliable, experienced man, thoroughly acquainted with the manufacture and distribution of gas and construction of works. Also a first-class gasfitter. Address "D.," care this Journal.

Situation Wanted

By a Gas Engineer and Retort Setter

of nineteen years' experience. Best of references. Address

613-1t "D. H.," care this Journal.

SITUATION WANTED.

A young man thoroughly competent to take complete charge of a gas plant of any magnitude is desirous of obtaining a situation. Is thoroughly versed in the most approved principles and practice of modern gas engineering. Best of references. Address "H. H.," Office this Journal.

MITCHELL, VANCE & CO.,

MANUFACTURERS OF

Chandeliers

and every description of

GAS FIXTURES.

Also manufacturers of Fine Gilt Bronzes and Marble Clocs warranted best time-keepers. Mantel Ornaments, etc.

Salesrooms, 836 Broadway, N. Y.

Special Designs furnished for Gas Fixtures for Churches, Public Halls, Lodges, etc.

WM. HENRY WHITE,

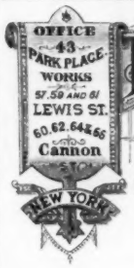
Consulting & Constructing

Gas Engineer & Contractor,

ESTIMATES, PLANS, AND SPECIFICATIONS FURNISHED FOR NEW WORKS OR EXTENSIONS OF EXISTING WORKS.

32 Pine St., New York City.

Correspondence solicited.



PROGRESS MACHINE WORKS.
A. & F. Brown.

Shafting, Pulleys,

HANGERS.

F. Brown's Patent Friction Clutch.

Send for Illustrated Catalogue and Discount Sheet to

A. & F. BROWN,

No. 43 Park Place, New York City.

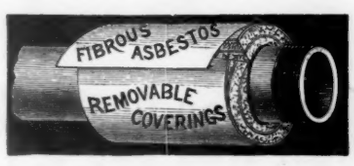
Pipe Coverings.

Fireproof, Non-Conducting Coverings for

STEAM PIPES, BOILERS,

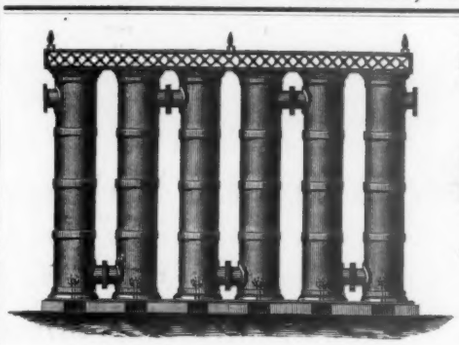
And all Hot Surfaces.

Made in sections three feet long. Easy to apply; light and cheap.



Asbestos Materials, Fibre, Braided Packing, and Cement. These goods are used at Continental Works, Br'klyn.

CHALMERS-SPENCE COMPANY, 419 & 421 EIGHTH ST., N. Y.



W. E. Tanner, Pres., W. R. Trigg, V.-Pres., A. Delaney, Supt.

Tanner & Delaney Engine Co.

RICHMOND, VA.

Gas Apparatus,

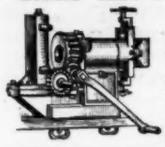
INCLUDING

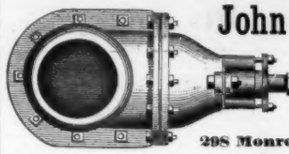
Condensers of various styles, Scrubbers, Holders, Purifiers, Castings for Retort Houses, Etc.

ALSO STEAM ENGINES AND BOILERS.

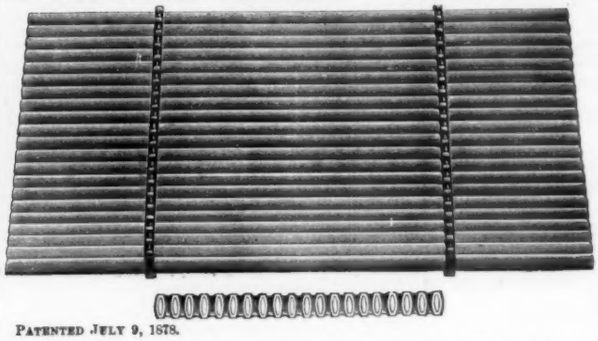
Plans, Specifications and Estimates Furnished.

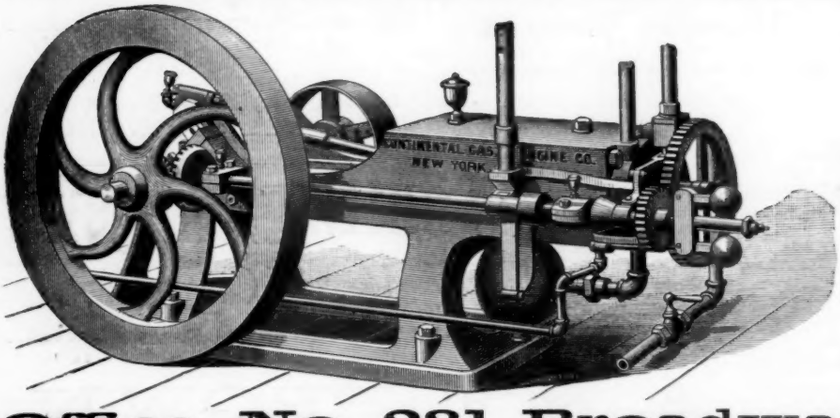
WM. FARMER, ENGINEER,
32 Park Place, Room 36, New York.
THE CHEMIST'S ASSISTANT; OR, KINDERGARTEN SYSTEM OF CHEMISTRY.
A system by which the elements and their valences are represented by illustrations and solid bodies.
BOX AND PAMPHLET COMPLETE, $2.50.

"ECLIPSE" HAND PIPE-CUTTING MACHINE.
No. 1.

Powerful, inexpensive, simple in construction; can be attached to any bench or plank in a few moments. Cuts and Screws Pipes ¼ to 2 in. Address for Prices,
PANCOAST & MAULE,
Philadelphia, Pa.
[Mention this Paper.]

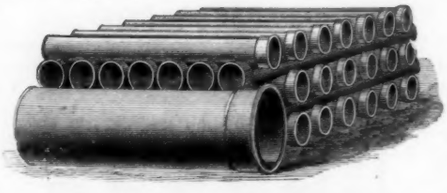

John McLean
Man'facturer of
GAS VALVES.
298 Monroe Street, N. Y.

Glass-Staining Gas Kiln.
BAKERS' & CONFECTIONERS' OVENS (PAT.)
Thompson Gas Kiln & Oven Co.
59 Carmine St., N. Y.
Send for Circular by mail.

CHURCH'S REVERSIBLE SCREEN FOR GAS PURIFIERS

PATENTED JULY 9, 1878.
Very Durable
Easily Repaired.
Oval Slats, with Malleable Iron Cross Bars.
Apply to
JOHN CABOT,
LAWRENCE, MASS.
References in all parts of the country. Send for circular and list of companies who now have the Screen in use.

THE CONTINENTAL GAS ENGINE COMPANY.


MANUFACTURERS OF
GAS ENGINES,
UNDER THE
GAUME AND OTHER PATENTS,
HAVE READY
Engines of ½, 1 and 1½ H.P.
Arranged for power or for pumping. 1-horse power will pump 1,000 gals. water 100 ft. high with 35 ft. of gas; ½-horse power will pump 500 gals. 100 ft. high per hour with 25 ft. of gas.
Each Engine Tested by Indicator and Meter.
SIMPLE, ECONOMICAL, SAFE, AND SUBSTANTIAL.
Call and see engines in operation, or address for circulars and prices.
Office, No. 231 Broadway, N. Y. City.

R. D. WOOD & CO.,
400 Chestnut Street, Phila., Pa.
Cast Iron Gas & Water Pipe, Water Machinery & Gas Apparatus
Cast Iron Pipe, Fire Hydrants, Eddy Valves, Lamp Posts, Large Loam Castings, Flanged Pipe, Sugar House Work, Iron Roofs and Floors, Wrought & Cast Iron Tanks, Turbine Water Wheels and Pumps.

Gasholders, Lime Trays, Center Valves, Purifiers, Bench Work, Exhausters, Condensers, Governors, Scrubbers, Gas Valves Station Meters, Cast Iron Pipe Fittings.
Manufacturers of Heavy Castings and Machinery of Every Description.
ENGINEERS & CONTRACTORS FOR THE ERECTION OF GAS WORKS, & ALL MACHINERY CONNECTED THEREWITH
Estimates and specifications furnished for erection of new works or the extension or alteration of old ones.
Foundries and Works, - - Millville, Florence, and Camden, N. J.

C. BARCALOW, PREST. J. V. BARCALOW, SEC. & TREAS.

BARTLETT
Street Lamp Mfg. Co.

MANUFACTURERS OF

Bartlett's Patent

GLOBE LAMPS.

FOR

Streets, Parks, Railroad Stations, Public Buildings, Etc.

LAMP POSTS A SPECIALTY.

Office and Salesroom,

No. 35 Howard Street, N. Y. City.

Gas Companies and others intending to erect lamps and posts will do well to communicate with us.

STREET LAMPS.

MANUFACTURED BY THE

Geo. D. Winchell Mfg. Co.,

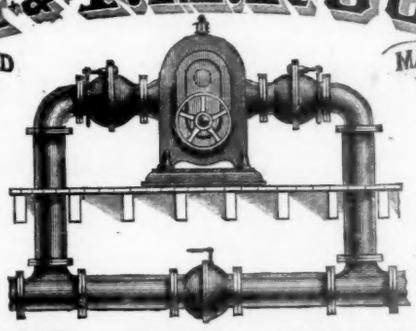
Cor. Bank & Riddle Streets,

CINCINNATI, OHIO.

F. M. ROOTS. S. C. ROOTS D. T. ROOTS.

P. H. & F. M. ROOTS,

PATENTEES AND MANUFACTURERS OF



Gas Valves, By-Pass Valves, Exhauster-Governors

Pipe Fittings, & All Fixtures for Exhauster Rooms.

IMPROVED GAS EXHAUSTER,

WITH ENGINE ON SAME BED PLATE, OR WITHOUT.

BYE-PASSES, GAS VALVES, GOVERNORS, ELBOWS, PIPE-FITTINGS, Etc., FURNISHED TO ORDER.

P. H. & F. M. ROOTS, Patentees & Manufacturers, **CONNERSVILLE, IND.**

S. S. TOWNSEND, General Agent, 22 Cortland St. and 9 Dey St., N. Y.
JAS. BEGGS & CO., Selling Agents, 9 Dey St., N. Y.
COOKE & CO., Selling Agents, 22 Cortland St., N. Y.

SEND FOR ILLUSTRATED CATALOGUE AND PRICE LIST.

THE GLOBE STREET LAMP.

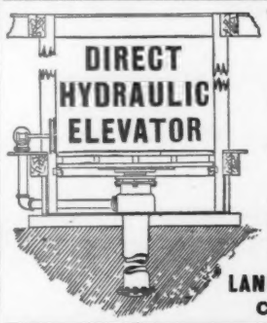
MINER'S PATENT STREET LAMPS.

Are adapted for use of Streets, Parks, Depots, Ferries, & Private Grounds.

WITH POSTS OR BRACKETS.

Jacob G. Miner,

MORRISANIA, N. Y. CITY.



With Iron or Wood Platform.

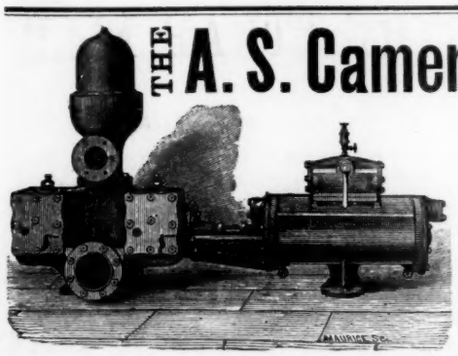
Largely used by Leading Gas Co.s for Coal and Coke Lifts.

Adapted for use with city service, or special pumping and accumulator system. For prices address the

LANE & BODLEY CO.,
Cincinnati, O.

THE

A. S. Cameron Steam Pump,



THE STANDARD OF EXCELLENCE.

Upward of 30,000 in Use.

BEST GAS WORKS PUMP
Ever Introduced.

Adapted to Every Possible Duty.

A. S. Cameron Steam Pump Works,

Foot East 23d St., N. Y.

Iron Sponge,

GAS EXHAUSTERS,

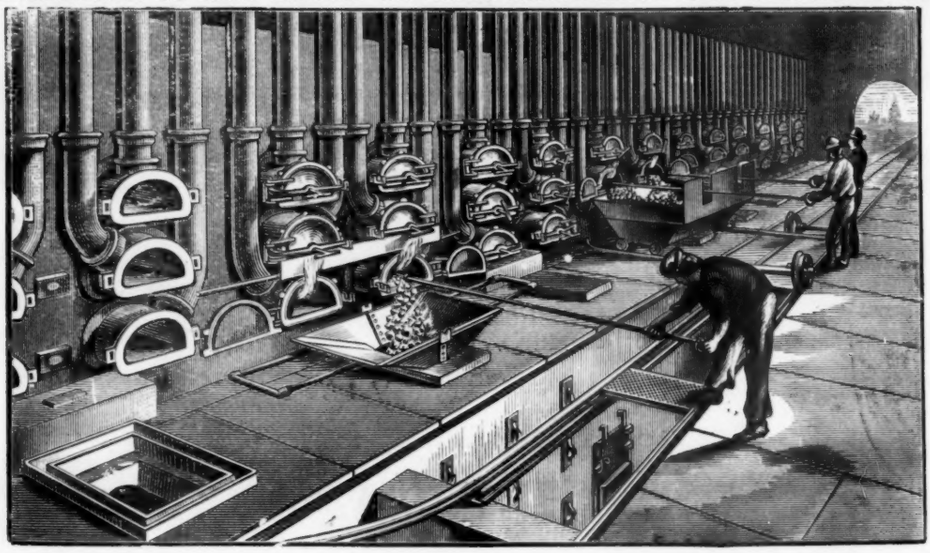
AUTOMATIC GAS GOVERNORS,

CONNELLY & CO., Limited,

No. 407 BROADWAY, NEW YORK CITY.

Chas. F. Dieterich's Regenerator Furnace.

CAN BE ADAPTED TO ANY BENCH WITHOUT DISTURBING THE ORDINARY SETTINGS.



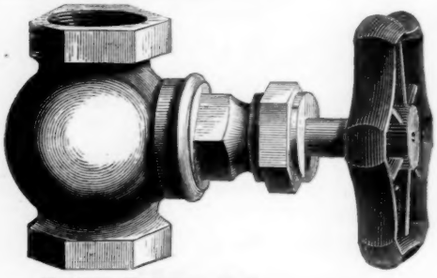
These Furnaces have been in operation at the works of the People's Gas Company, Baltimore, since June, 1878. A bench of sixes, with retorts 20 in. by 12 in. by 8 ft. 6 in. will burn off 1,350 pounds of coal in 3 hours. Twenty-five per cent. of the coke is sufficient to thoroughly burn off the charges.

We refer by permission to the following Companies who are using these Furnaces:

A. B. SLATER, Providence Gas Co. **S. G. STINESS**, Pawtucket Gas Co. **JAS. H. ARMINGTON**, Brooklyn Gas Lt. Co.

State, city, and factory rights granted on reasonable terms. For full particulars apply to

CHAS. F. DIETERICH, Engineer P. O. Box 512, BALTIMORE, MD.



Factory, Paterson, N. J.

McNab & Harlin Mfg. Co.,

MANUFACTURERS OF

BRASS COCKS & VALVES

FOR STEAM, WATER, AND GAS.

Iron Pipes and Fittings

Seamless Brass & Copper Tubes.

Illustrated Catalogue and Price List.

56 JOHN STREET, N. Y.

The Management of Small Gas Works.

BY C. J. R. HUMPHREYS.

Price, $1.

Orders to be sent to **A. M. CALLENDER & CO.,** 42 PINE STREET, NEW YORK.

King's Treatise on Coal Gas.

The most complete work on Coal Gas ever published.

Three Vols. Bound, $30.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

BOOKS.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR.

By GEORGE LUNGE. Price $8.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS.

By DAVID A. GRAHAM. 8vo., Cloth. Price $3.

Orders for these books may be sent to this office.

A. M. CALLENDER & CO.,
42 PINE ST., N. Y. CITY.

PRESERVE

The Journal

BY THE USE OF

THE STRAP FILE.

Advantages of the Strap File.

1st. It is simple, strong, and easily used.

2d. Preserves papers without punching holes.

3d. Will always lie flat open.

4th. Allows any paper on file to be taken off without disturbing the others.

Price, $1.25. Sent either by express or mail, as directed. By mail the postage will be 20 cents which will be added to the price of the Binder.

A. M. CALLENDER & CO., 42 PINE ST., N. Y.

CATHELL'S

Gas Consumer's Manual.

Enables every gas consumer to ascertain at a glance, without any previous knowledge of the gas meter, the quantity and money value of the gas consumed. Also the best method of obtaining from gas the largest amount of its light. It will be to the advantage of Gas Companies to supply their consumers with one of these Guides, as a means of preventing complaint arising from their want of knowledge in regard to the registration of meters.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

FODELL'S

System of Bookkeeping

FOR GAS COMPANIES.

Price $5, which should be sent either in Check, P. O. Ord or Registered Letter.

Blank Books, with printed headings and forms on this system, will be supplied to Gas Companies, by applying to W. P. BELL Philadelphia, or

A. M. CALLENDER & CO
OFFICE GAS LIGHT JOURNAL 42 Pine St., N. Y.

THE AMERICAN METER COMPANY,

MANUFACTORIES,

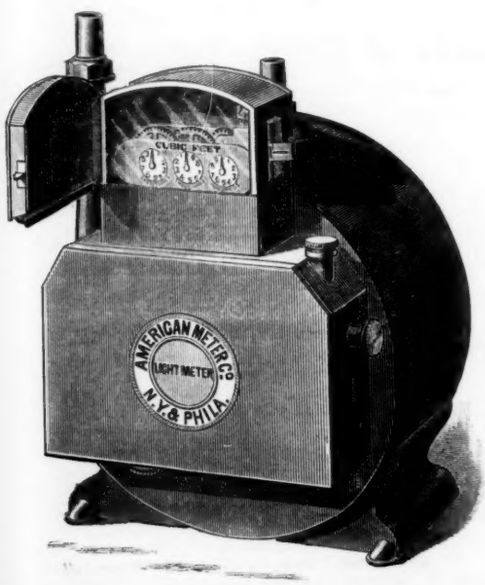
512 West Twenty-second Street, N. Y. **Arch and Twenty-second Street, Phila.**

Nos. 244 & 246 North Wells Street, Chicago, Ill.

AGENCIES,

No. 177 Elm Street, Cincinnati, Ohio. Nos. 122 & 124 Sutter Street, San Francisco, Cal.

No. 810 North Second Street, St. Louis, Mo.



Mfr's of STANDARD WET AND DRY GAS METERS.

J. H. GAUTIER & CO.,
CORNER OF
GREENE AND ESSEX STREETS,
JERSEY CITY, N. J.
MANUFACTURERS OF
Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels.
J. H. GAUTIER. T. B. GAUTIER.
C. E. GREGORY. C. E. GAUTIER.

BROOKLYN
Clay Retort & Fire Brick Works,
(EDWARD D. WHITE & CO.)
Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.
VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.
Office, 88 Van Dyke St., Brooklyn, N. Y.

LACLEDE FIRE BRICK MFG. CO.,
MANUFACTURERS OF
Fire Brick, Gas Retorts,
AND
ST. LOUIS STANDARD SEWER PIPE.
Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.
OFFICE AND DEPOT
901, 903, and 905 Pine Street,
ST. LOUIS, MO.

ESTABLISHED IN 1845.
B. KREISCHER & SONS,
OFFICE FOOT OF HOUSTON ST., E.R., N.Y.
Gas Retorts,
TILES, FIRE BRICK.
AND EVERYTHING IN THE FIRE CLAY LINE.

MANHATTAN
FIRE BRICK & ENAMELLED CLAY
RETORT WORKS.
ADAM WEBER.
CLAY GAS RETORTS
AND RETORT SETTINGS,
FIRE BRICKS, TILES, ETC.,
Office and Works, 15th Street and Avenue C., N. Y.

Borgner & O'Brien,
MANUFACTURERS OF
CLAY GAS RETORTS
AND RETORT SETTINGS,
FIRE BRICKS, TILES, ETC.
23d St., Above Race,
PHILADELPHIA.
TWENTY YEARS' PRACTICAL EXPERIENCE.

JAMES GARDNER, JR. WILLIAM GARDNER.
Works, LOCKPORT STATION, PA.
—ESTABLISHED 1864.—
WILLIAM GARDNER & SON,
Successor to GARDNER BROTHERS.
Office, COAL EXCHANGE, PITTSBURGH, PA, P. O. Box 373.
Fire Clay Goods for Gas Works.
C. H. SPRAGUE, No. 70 KILBY STREET, BOSTON, MASS., Agent for the New England States.

OFFICE, 418 to 422 East 23d St., New York. ESTABLISHED 1856. WORKS, PERTH AMBOY, NEW JERSEY.
HENRY MAURER,
Excelsior Fire Brick & Clay Retort Works
CLAY GAS RETORTS, BENCH SETTINGS, FIRE BRICK, TILES, ETC.

STANDARD GAS RETORT AND FIRE BRICK COMPANY,
J. ANDERSON, PRES. & MANG'R. OF IRONTON, OHIO. C. PETERS, SECRETARY.
Clay Gas Retorts, Fire Brick, and Fire Clay Goods of Every Description.
Plans of Livesey-Somerville, McIlhenny, and other Furnaces, and Competent Workmen Supplied.

CHICAGO
Retort & Fire Brick Works,
Office, 79 Dearborn St., Unity Building. | Factory, 45th and Clark Sts.
CHICAGO, ILL.
GEORGE C. HICKS, PRES. PAUL P. AUSTIN, SEC. & TREAS.
STANDARD
Clay Retorts and Settings.
BLOCKS & TILES
Of every Shape and Size to Order.
Standard Fire Bricks.

NEWBIGGING'S
Gas Manager's Handbook.
Price, $4.80.
EVERY GAS MAN SHOULD HAVE ONE.
Orders may be sent to this Office.

OAKHILL
GAS RETORT & FIRE BRICK
COMPANY.
PARKER, RUSSELL & CO.
City Office, 45th & Clark Sts,
ST. LOUIS, MO.
Our immense establishment is now employed almost entirely in the manufacture of
MATERIALS FOR GAS COMPANIES.
We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. Our customers are in almost every State of the Union, to all of whom we refer.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Sup
BALTIMORE
RETORT & FIRE BRICK CO.
MANUFACTORY AT
LOCUST POINT, BALTIMORE, MD.
Connection with the City by Telephone.
Clay Retorts, Blocks & Tiles,
FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.
Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.
WALDO BROS., 88 WATER ST., BOSTON, MASS.
Sole Agents for New England States

Siemens's Regenerative Gas Burners,

For Lighting and Ventilating.

THE CHEAPEST, PUREST, AND MOST BRILLIANT OF ALL GAS LIGHTS.

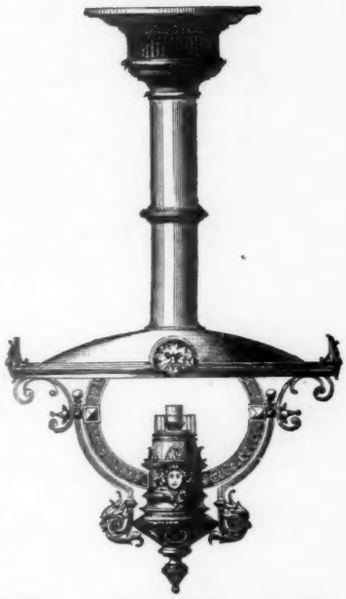
Superior to the Electric Light in Economy, Beauty, & Steadiness.

SPECIALLY ADAPTED FOR LIGHTING HALLS, FACTORIES, OPEN SPACES, ETC.

Numerous Tests made by various Gas Companies in the United States show an Efficiency of Ten Candle Power per Cubic Foot of Gas.

General Agents:

SIEMENS LIGHTING CO., 347 West Main St., Louisville, Ky.
MEYER, MARSHALL & CO., 528 California St., San Francisco.
DENNEHY, WOLF & O'BRIEN, 85 & 87 Dearborn St. Chicago, Ill.
WILCOX & McCEARY, - No. 11 Bissel Block, Pittsburgh, Pa.
T. T. RAMSDELL & CO., - 20 Swan Street, Buffalo, N. Y.
SIEMENS GAS ILLUMINATING CO., Room 6, No. 157 Broadway, New York City.
W. D. COLT, - - - - 1420 F Street, Washington, D. C.
JOHN KIEFER, - - - 344 Lawrence, Street, Denver, Col.



THE SIEMENS REGENERATIVE GAS LAMP COMPANY,

SOLE MAKERS FOR THE UNITED STATES,

N. E. Cor. 21st. St. and Washington Av., Philadelphia, Pa.

THE "STANDARD" WASHER-SCRUBBER,

KIRKHAM, HULETT & CHANDLER'S PATENT.

Total Capacity per 24 Hours of "Standard" Washers Ordered During the Following Years.

1877	4,000,000 cubic feet.
1878	4,750,000 "
1879	24,545,000 "
1880	42,967,500 "
1881	36,462,500 "
1882	39,300,000 "
1883	57,735,000 "
1884	26,177,500 "
Total	235,937,500 cubic feet.

Total Number and Capacity per 24 Hours of "Standard" Washers Erected and in Course of Erection in the Several Countries

	Number.	Cubic Feet per Day.
Great Britain	151	157,070,000
Western Hemisphere	38	39,337,500
Australia	18	12,150,000
New Zealand	2	650,000
France	6	4,550,000
Belgium	8	5,420,000
Germany	16	8,200,000
Holland	4	4,160,000
Denmark	1	150,000
Russia	2	3,500,000
Spain	1	350,000
India	1	400,000
Total	248	235,937,500

THE CONTINUED POPULARITY

Of these Machines

Will be recognized from the following extracts from letters from representatives of some of the companies having them in use:

PITTSBURGH GAS CO., Nov. 25, 1884.

GEO. SHEPARD PAGE, Esq.:

Dear Sir—We use 1¼ galls. water per 1,000 cubic feet, and obtain 11-oz. liquor. All the ammonia is removed from the gas, with one chamber clean. Six-tenths pressure runs the machine. It is running to our entire satisfaction. Respectfully yours,

[Signed] JOHN H. McELROY, Engr.

LACLEDE GAS WORKS, St. LOUIS, Nov. 25, 1884.

GEO. SHEPARD PAGE, Esq.:

Dear Sir—The Scrubber is performing its work to our entire satisfaction. It has passed and thoroughly freed from ammonia 30 per cent. more gas than it was rated as being able to pass. The test paper shows not a trace of ammonia at the outlet. Respectfully yours,

[Signed] FREDERIC EGNER, Engr. and Supt.

"Standard" Washers Ordered During the Current Year.

	Cu. Ft. per Day
Anneberg Gas Co	200,000
Bombay Gas Co	400,000
Brussels Co	1,250,000
Chemnitz Gas Co	1,000,000
CITIZENS GAS CO., BUFFALO	750,000
Coke Works in Zabre, Ober-Schlesien	1,500,000
Cokerei der Friedenshutte, Upper Silesia	700,000
Dumfries Corporation	250,000
Dunedin Gas Co., New Zealand	400,000
King's Lynn Gas Co	300,000
Leiden, Holland	600,000
Lincoln Gas Co	400,000
Liverpool Gas Co	2,000,000
" "	3,000,000
LOUISVILLE GAS CO	1,500,000
Numea Gas Co	100,000
PITTSBURGH GAS CO	1,500,000
PORTLAND GAS CO., Oregon	562,500
SAN FRANCISCO GAS CO	4,000,000
Sheepbridge	40,000
ST. LOUIS GAS CO	2,000,000
Sydney Gas Co	2,500,000
WASHINGTON, D. C. GAS CO	2,000,000
Whitchurch Gas Co	175,000
Total	26,177,500

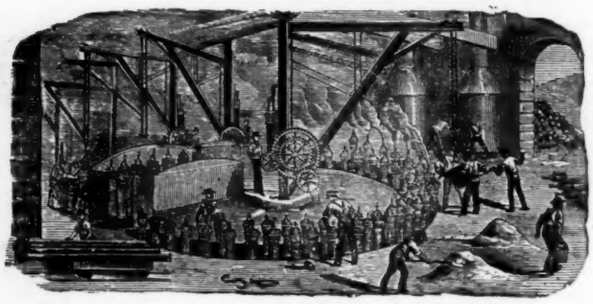
GEO. SHEPARD PAGE, No. 69 WALL STREET, NEW YORK,

SOLE AGENT FOR THE WESTERN HEMISPHERE.

A. H. M'NEAL,

BURLINGTON, N. J.

Flange-Pipes



General Foundry Work.

CAST IRON PIPES

FOR WATER AND GAS.

JAMES S. MOORE, Pres. BENJAMIN CHEW, Treas.

JAS. P. MICHELLON, Sec. WM. SEXTON, Supt.

GLOUCESTER IRON WORKS,

GLOUCESTER CITY N. J.

Cast Iron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gasholders. &c.

Office No. 6 North Seventh Street, Philadelphia.

ESTABLISHED 1856.

WARREN FOUNDRY AND MACHINE CO.,

WORKS AT PHILLIPSBURGH, N. J.

NEW YORK OFFICE, 162 BROADWAY.

Cast Iron Water and Gas Pipe

FROM TWO TO FORTY-EIGHT INCHES DIAMETER.

ALSO ALL SIZES OF

FLANGE PIPE for Sugar House and Mine Work.

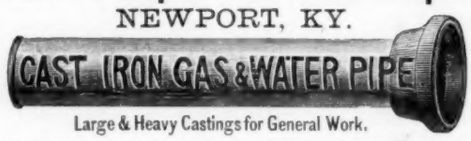
Branches, Bends, Retorts, Etc., Etc. 456-1

MATTHEW ADDY, President. W. L. DAVIS, Selling Agent. GEO. P. WILSHIRE, Sec. & Treas.

Cincinnati and Newport Iron and Pipe Company,

NEWPORT, KY.

Lamp Posts AND **BENCH CASTINGS** A Specialty.



Large & Heavy Castings for General Work.

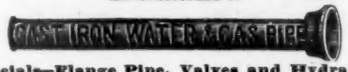
Branch AND SPECIAL CASTINGS FOR GAS & WATER CO'S.

Manufacture Pipe from 2 to 48 inches. All work guaranteed first quality.

Mellert Foundry and Machine Co.

Limited. Established 1848.

MANUFACTURERS OF



Specials—Flange Pipe, Valves and Hydrants, Lamp Posts, Retorts, etc.

Machinery and castings for Furnaces, Rolling Mills, Grist and Saw Mills, Mining Pumps, Hoists, etc.

GENERAL OFFICE, - - - READING, PA.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

248 N. 8th Street, Phila., Pa.

WALTER ANDERSON,

Manufacturer of all descriptions of

GAS BURNERS.

Also Metal E H. Nickel Plated Tips for Water Gas.

COR. WHITE AND ELM STS., N. Y.

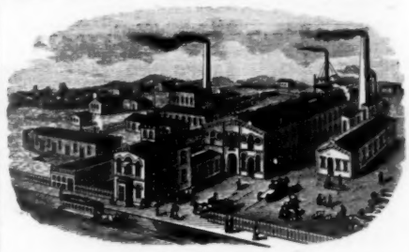
MORRIS, TASKER & CO.,

Limited,

Builders of Gas Works,

PHILADELPHIA, PA.

LUDLOW VALVE MFG. CO



OFFICE AND WORKS,

938 to 954 River Street and 67 to 83 Vail Av.

TROY, N. Y.

Hydraulic Main Dip Regulators, also Check Valves, Foot Valves, Yard-wash and Fire Hydrants. Send for Circulars.

Valves.—Double and Single Gate, ¾ in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil. Send for Circulars.

JOS. R. THOMAS, C.E.,

May be Consulted on all Matters Relating to Gas Works and Gas Manufacture.

ADDRESS THIS OFFICE.

The Kerr Murray Mfg. Co.,

MANUFACTURERS OF

BENCH CASTINGS,

Boilers and Engines,

STEAM JET AND ROTARY EXHAUSTERS.

HOT TAR SCRUBBERS.

Annular and Pipe Air Condensers.

Multitubular Water Condensers,

WATER SPRAY WASHERS,

Purifiers, Ash Lime Trays, Improved Dry Center Seals, Meter Bye-Passes, Hub & Flange Stop Valves.

Gasholders,

SINGLE AND DOUBLE LIFT.

Latest and most improved patterns of gas apparatus, from 4 to 30 inch openings. Plans, specifications, and estimates furnished for erection of new and rebuilding of old works.

Kerr Murray Mfg. Co.,

FORT WAYNE, IND.

JAMES R. FLOYD,

(SUCCESSOR TO HERRING & FLOYD)

Oregon Iron Works,

531 to 543 West 20th St., N. Y.

Practical Builders of Gas Works,

MANUFACTURERS OF

ALL KINDS OF CASTINGS AND APPARATUS FOR GAS-WORKS.

BENCH CASTINGS from benches of one to six Retorts each.

WASHERS: MULTITUBLAR AND AIR CONDENSERS; CONDENSERS; SCRUBBERS (wet and dry), and

EXHAUSTERS for relieving Retorts from pressure.

BENDS and BRANCHES of all sizes and description.

FLOYD'S PATENT **MALLEABLE RETORT LID.**

PATENT **SELF-SEALING RETORT LIDS.**

FARMER'S **PATENT BYE-PASS DIP-PIPE.**

SABBATON'S PATENT **FURNACE DOOR AND FRAME.**

BUTLER'S **COKE SCREENING SHOVELS.**

GAS GOVERNORS,

and everything connected with well regulated Gas Works at low price, and in complete order.

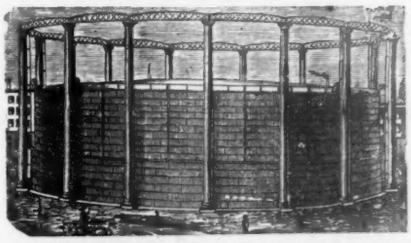
SELLER'S CEMENT

for stopping leaks in Retorts.

N. B.—**STOP VALVES** from three to thirty inches—very low prices.

Plans, Specifications, and Estimates furnished.

CONTINENTAL WORKS.



GASHOLDERS OF ANY MAGNITUDE.

T. F. ROWLAND, Proprietor,
GREENPOINT, BROOKLYN, N. Y.
ENGINEER AND MANUFACTURER OF

GAS-HOLDERS.

CONDENSERS, SCRUBBERS, VALVES, PURIFIERS, RETORTS, and HYDRAULIC MAINS,

and all other articles connected with the Manufacture Distribution of Gas. Plans and Specifications prepared and Proposals given for the necessary Plant for Lighting Cities, Towns, Mansions, and Manufactories.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Pres. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.

STACEY MFG. CO.,

MANUFACTURERS OF

Single and Telescopic Gasholders,

IRON ROOFS, BRIDGES, LAMP POSTS,

Water and Oil Tanks, Coal Elevator Cars,

COKE CRUSHERS, BENCH CASTINGS,

And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works. Rolling Mill Machinery and Heavy Castings a Specialty.

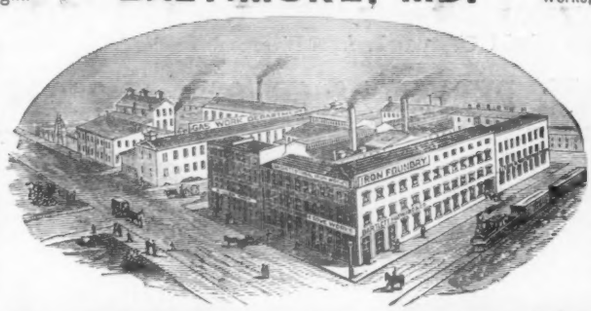
Foundry: 33, 35, 37 & 39 Mill Street.
Wrought Iron Works: 16, 18, 20, 22, 24 & 26 Ramsey Street.

Cincinnati, Ohio.

BARTLETT, HAYWARD & CO.,

Office, 24 Light. **BALTIMORE, MD.** Works, Pratt & Scott.

PURIFIERS. Roofs. Bench Castings.



SCRUBBERS. BOILERS. CONDENSERS.

GASHOLDERS.

CONSTRUCTING ENGINEERS AND BUILDERS OF GAS WORKS.

1842. DEILY & FOWLER, 1884.

Laurel Iron Works.

Address, No. 39 Laurel Street, Philadelphia, Pa.

MANUFACTURERS OF

GASHOLDERS,

Single or Telescopic, with Cast or Wrought Iron Guide Frames.

Holders Built Since 1880:

Mount Joy, Pa.
Rockaway B'ch, N.Y. (2)
Zanesville, O. (2d.)
Lancaster, O.
Blackwell's Island N. Y.
Waltham, Mass., (1st.)
Dorchester, Mass.
Wheeling, West Va.
Lansing, Mich.
Flint, Mich.
Galveston, Texas (1st.)
Milton, Pa.
Scranton, Pa.
West Point, N. Y.
Fitchburgh, Mass.
New London, Conn.
Derby, Conn.
Bridgeport, Conn.
Allegheny, Pa. (1st.)
St. Hyacinth, Can.
Norwalk, O.
Brattleboro, Vt.
Waltham, Mass (2d.)
West Chester, Pa.
Baltimore, Md.
Hollidaysburg, Pa.
Galveston, Texas (2d.)
Marlboro, Mass.
Denver, Col.
Chicago, Ill. (West Side).
Pittsburgh, Pa. (S. Side).
Pawtucket, R. I.
Brookline, Mass.
Sherbrooke, Can.
Burlington, N. J. (2d.)
Bridgeton, N. J.
Bay City, Mich.
Erie, Pa.
Jackson, Mich.
Kalamazoo, Mich. (3d.)
Glen Island, N. Y.
Warren, Ohio.
Bath, N. Y.
Lynn, Mass.
New Bedford, Mass.
Waterbury, Conn.
Deseronto, Can.
Hoosic Falls, N. Y. (2d.)
Bethlehem, Pa.
Atlanta, Ga. (1st.)
Savannah, Ga.
Montgomery, Ala
Newport, R. I.
Portland, Oregon.
Allegheny, Pa. (2d.)
Atlanta, Ga. (2d.)
N.Y.City (Central Gas Co.
Lynchburg, Va (2d.)
Saylesville, R. I.
Rondout, N. Y.
Atlantic Cit', N. J.
Augusta, Ga.
Wa.tham, Mass. (2d

GAS COALS. GAS COALS. GAS COALS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

General Sales Agents.

THE YOUGHIOGHENY RIVER COAL COMPANY,

Organized August 1, 1882.

MINERS AND SHIPPERS OF THE WELL-KNOWN

Ocean Mine Youghiogheny Gas Coal.

The Coal from the Ocean Mine (recently operated by Messrs. W. L. Scott & Co., of Erie, Pa.,) is now used by all the leading Gas Companies in the United States from Maine to Texas, and is recognized as *the only reliable Youghiogheny Gas Coal.*

Messrs. W. L. Scott & Co. and W. L. Scott, Esq., still retain their interest in the new Company, and the same general policy which has characterized the management of the mine under these gentlemen will be continued by the new Company. With largely increased facilities and *unlimited supply of Coal*, any demand made upon the Colliery will meet with prompt fulfillment.

THE UNDERSIGNED CAN SUPPLY THE FOLLOWING SUPERIOR GRADES OF

GAS CANNELS:

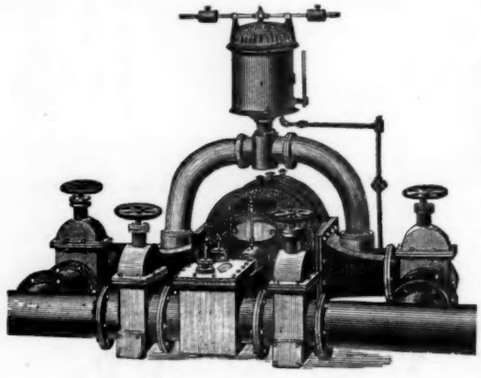
Abram Cannel, from the Abram Colliery, Wigan, England,

Plesio-Boghead Cannel, from near the old Boghead Colliery, Scotland.

North Ince Hall Cannel, from Liverpool, England.

Breckenridge Cannel, from Kentucky. The railroad now being constructed to the Ohio river will open up this superior Cannel deposit, and enable us to deliver it at any required point. See full description of this Cannel, and Map of the Colliery, in the "American Gas Light Journal," April 16, 1883, pages 172 and 173.

P. O. Box 3695, New York. **PERKINS & CO., 228 and 229 N. Y. Produce Exchange** BEAVER STREET ENTRANCE.



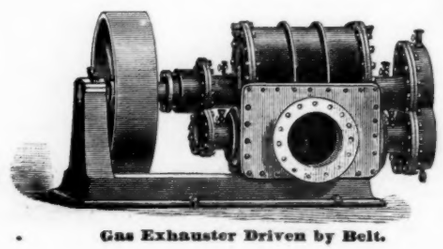
SMITH & SAYRE MFG. COMPANY,

G. G. PORTER, Prest. *245 Broadway, N. Y.* CHAS. W. ISBELL, Sec'y.

Machinery & Apparatus for Gas Works

Drawings, Plans, and Estimates Furnished for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

Mackenzie's Patent Rotary and Steam Jet Gas Exhausters, Governors, Compensators, Condensers, Washers, Scrubbers. Isbell's Patent Automatic Street Pressure Governor, Gas and Water Valves, Hydraulic Main Dip Regulator, Bench Castings, etc. Purifying Boxes and "Standard" Scrubbers. Isbell's Patent Self-Sealing Retort Doors.



Gas Exhauster Driven by Belt.

The Wilbraham Gas Exhauster,

"BAKER SYSTEM,"

WITH ENGINE ATTACHED, ON SAME BED PLATE OR WITHOUT.

Best, Cheapest and Most Durable Exhauster known.

WILBRAHAM BROS.,

No. 2320 Frankford Avenue, Philadelphia, Pa.

GAS COALS. GAS COALS. GAS COALS.

Newburgh Orrel Coal Co.,

MINERS AND SHIPPERS OF

Newburgh Orrel, Tyrconnell and Palatine Gas Coals.

ALSO SHIPPERS OF FOUNDRY COKE.

Mines Situated at

Newburgh, Flemington & Fairmont, W.Va.

HOME OFFICE,

25 S. Gay St., Baltimore.

CHARLES MACKALL,
MANAGER.

CHAS. W. HAYS, Agent in New York,
Room 92, WASHINGTON BUILDING, No. 1 Broadway.

Shipping wharves at Locust Point. References furnished when required. Special attention given to chartering vessels.

THE DESPARD COAL COMPANY

OFFER THEIR SUPERIOR

DESPARD COAL

To Gas Light Companies and Manufacturers of Fire Clay Goods Throughout the Country.

ROUSSEL & HICKS, 71 Broadway, N. Y. — *AGENTS.* — BANGS & HORTON, 16 Kilby St., Boston.

Mines in Harrison Co., West Va. Wharves, Locust Point, Balt.

Company's Office, 15 German St., Baltimore, Md.

Among the consumers of Despard Coal we name: Manhattan Gas Light Co., N. Y.; Metropolitan Gas Light Co., N. Y.; Jersey City, (N. J.) Gas Light Co.; Washington (D. C.) Gas Light Co.; Portland (Maine) Gas Light Co. Reference to them is requested.

1,000 Engines Now in Use.

30,000 H.P. NOW RUNNING!

Sales, 2,000 H.P. per Month!

SEND FOR ILLUSTRATED CIRCULAR AND REFERENCE LIST.

Westinghouse Machine Co.,

PITTSBURCH, PA.

SALES DEPARTMENT CONDUCTED BY

Westinghouse, Church, Kerr & Co., 17 Cortlandt Street, New York City.
Fairbanks, Morse & Co., Chicago, Cincinnati, Cleveland, Louisville, and St. Paul.
Fairbanks & Co., St. Louis, Indianapolis, and Denver.
Parke & Lacy, San Francisco, and Portland, Or.
Parke, Lacy & Co., Salt Lake City, Utah.
Imray, Hirsch & Kaeppel, Sydney and Melbourne, Australia.

THE

PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,

AND PREPARED FOR

GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station on the Pennsylvania Railroad, and on the Youghiogheny River.

OFFICES

No. 209 South Third Street, Phil'a. 90 Wall Street, New York.

PLACES OF SHIPMENT.

Pennsylvania Railroad, Pier No. 2 (Lower Side).
Greenwich Wharves, Delaware River.
366-1y **Pier No. 1 (Lower Side), South Amboy, N. J.**

Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS.

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

C. B. ORCUTT, Sales Agent. | **OFFICE, 150 BROADWAY, N Y.**

FRANCIS H. JACKSON, PRESIDENT. EDMUND H. McCULLOUGH, SEC. & TREAS.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

The Bower Gas Lamp.

The Perfected Duplex-Regenerative Gas Burner, under the combined Patents of Anthony S. Bower, Geo. S. Grimston, and Thos. Thorp.

The First Gold Medal awarded at the Crystal Palace Exhibition in London, and two Gold Medals at the Stockport (Eng.) Exhibition of Gas Appliances. Both in 1883.

GEO. SHEPARD PAGE, JOHN BOWER,
69 Wall Street, N. Y. City.

The Management of Small Gas Works.

By C. J. R. HUMPHREYS. Price, $1.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

INTERNATIONAL--1876--EXHIBITION.

The U. S. Centennial Commission

HAVE DECREED AN AWARD TO

HARRIS, GRIFFIN & CO.,

12th and Brown Sts., Philadelphia, and 49 Dey St., N. Y., U. S, A.,

FOR THE FOLLOWING REASONS:

The Exhibit consists of a Series of METERS from the Largest Size Station Meters for the use of the MANUFACTURE OF GAS, to those for the use of the ORDINARY CONSUMER. The Instruments are WELL MADE, RELIABLE as to INDICATION, and embody a number of sundry improvements which, with the general character of the Exhibit, entitle the whole to commendation.

Attest—J. L. CAMPBELL, Secretary, pro-tem. Signed—A. T. GOSHORN, Director General J. R. HAWLEY, President

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

Maryland Meter and Manufacturing Co.,

DICKEY, TANSLEY & CO.,

Established 1866.

Nos. 22 and 24 Saratoga Street, Baltimore, Md.
No. 46 La Salle St., Chicago, Ill.

MANUFACTURERS OF

DRY GAS METERS, STATION METERS, GLAZED METERS, TEST METERS, METER PROVERS, PRESSURE AND VACUUM REGISTERS, GOVERNORS, INDICATORS, SERVICE AND METER COCKS, AND METER CONNECTIONS.

Dry Gas Meter.

With 39 years' experience and the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

No. 153 Franklin Street, Boston, Mass.,

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges, Pressure and Vacuum Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Patent Cluster Lanterns for Street Illumination.

SCIENTIFIC BOOKS.

We are prepared to furnish to Gas Managers, and others interested in the topics treated of, the following books, at prices named:

KING'S TREATISE ON THE MANUFACTURE OF COAL GAS. Three vols.; $10 per vol.

GAS MANUFACTURE, by WILLIAM RICHARDS. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

THE GAS ANALYST'S MANUAL, by F. W. HARTLEY. $2.50.

ANALYSIS, TECHNICAL VALUATION, PURIFICATION, and USE OF COAL GAS, by REV. W. R. BOWDITCH, M.A.; with Engravings; 8vo., Cloth. $4.50.

GAS MEASUREMENT AND GAS METER TESTING by F. W. HARTLEY. $1.60.

GAS CONSUMER'S HANDBOOK, by WILLIAM RICHARDS, C.E.; 18mo., Sewed. 20 cents.

GAS CONSUMER'S MANUAL, by E. S. CATHELS, C.E. 10 cts.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

FODELL'S SYSTEM OF BOOKKEEPING FOR GAS COMPANIES. $5.

GAS WORKS—THEIR ARRANGEMENT, CONSTRUCTION, PLANT, AND MACHINERY. $8.

COAL; ITS HISTORY AND USE, by PROF. THORPE. $3.50.

THE GAS WORKS OF LONDON, by COLBURN. 60 cents.

THE GAS FITTER'S GUIDE, Showing the Principles and Practice of Lighting with Coal Gas, by JOHN ELDREDGE. 40 cents.

CORRECT GAS MEASUREMENT; the serious Loss and Inconvenience to Gas Companies and the Public Caused by the Freezing and Inaccuracy of Wet Gas Meters, by GEORGE GLOVER. 40 cents.

GAS WORKS, AND MANUFACTURING COAL GAS, HUGHES. $1.40.

A PRACTICAL TREATISE ON GAS AND VENTILATION, with Special Relation to Illuminating, Heating, and Cooking by Gas, by E. E. PERKINS. $1.25.

APPARATUS AND FITTINGS FOR GAS WORKS, by F. COLYER. 8vo., Cloth. $8.

GAS CONSUMER'S HANDY BOOK, by W. RICHARDS. 18 mo., Paper. 20 cents.

The above will be forwarded by express, upon receipt of price. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order.

A. M. CALLENDER & CO., No. 42 Pine Street, New York.

T. C. HOPPER, Pres. G. J. McGOURKEY, Vice-Pres. (New York). WM. N. MILSTED, Gen. Supt. & Treas. (New York). WM. H. DOWN Sec.

AMERICAN METER COMPANY,

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTRE VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR AND JET PHOTOMETERS.

Manufactories:
512 W. 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES,
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
177 Elm Street, Cincinnati.
244 & 246 N. Wells Street, Chicago.
810 North Second Street, St. Louis.
122 & 124 Sutter St., San Francisco

HELME & McILHENNY.

Successors to Harris & Brother.

ESTABLISHED 1848.

PRACTICAL GAS METER MANUFACTURERS,

Continue as heretofore at the OLD ESTABLISHMENT, Nos. 1115 and 1117 Cherry Street, Philadelphia, Pa.

To manufacture Wet and Dry Gas Meters, Station Meters, Experimental Meters, Meter Provers, Centre Seals, Governors, Pressure Registers, Indicators, Photometers, and all kinds of Gas Apparatus; Also furnish all other Articles appertaining to the use of Gas Works.

From our long Practical Experience of the Business (covering a period of 33 years) and from our personal supervision of all Work, we can guarantee all orders to be executed promptly, and in every respect satisfactorily.

WILLIAM HELME JOHN McILHENNY.

WM. WALLACE GOODWIN, Prest. and Treas. WM. H. MERRICK, V.-Prest. S. L. JONES, Sec. S. V. MERRICK, Asst. Sec

THE GOODWIN GAS STOVE AND METER COMPANY,

Successors to W. W. GOODWIN & CO.

1012, 1014 and 1016 Filbert St., Phila., Pa 142 Chambers St., New York.
126 Dearborn St., Chicago, Ill.

WALDO BROS., Agents, 88 Water St., Boston.

MANUFACTURERS OF THE "SUN DIAL" GAS STOVES, FOR COOKING AND HEATING PURPOSES.

Dry and Wet GAS METERS, Station Meters (Square, Cylindrical or in Staves) Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, Etc., Etc., Meter Provers (sizes 2, 5 and 10 feet), Pressure Guages of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4 inch, 6 inch and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Centre Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete—also Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

GOODWIN'S IMPROVED LOWE'S JET PHOTOMETER.

Agents for Bray's Patent Gas Burners and Lanterns.

Special attention to repairs of Meters, and all apparatus connected with the business. G. B. EDWARDS, Mang'r, New York.
All work guaranteed first class in every particular, and orders filled promptly. E. H. B. TWINING, Mang'r, Chicago.

D. McDONALD & CO.,

GAS METER MANUFACTURERS.

(Established 1854.)

No. 51 Lancaster Street, Albany, N. Y.

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS, PRESSURE GAUGES, ETC.

Also STAR GAS STOVES, RANGES, and HEATING STOVES.

We use only the very best materials, and employ the most skilled labor, and by our long experience (29 years) and personal supervision of every detail, we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the State Inspector's Badge, and will be fully warranted by us. Our Annual and Calendar will be sent to Gas Companies upon application.

KING'S TREATISE ON COAL GAS.

The most complete work on Coal Gas ever published. Three vols., bound, $30.

A. M. CALLENDER & CO., No. 42 Pine Street, New York.

THE "OTTO" GAS ENGINE.

Guaranteed to Consume 25 to 75 Per Cent. LESS GAS than ANY OTHER GAS ENGINE PER BRAKE HORSE POWER.

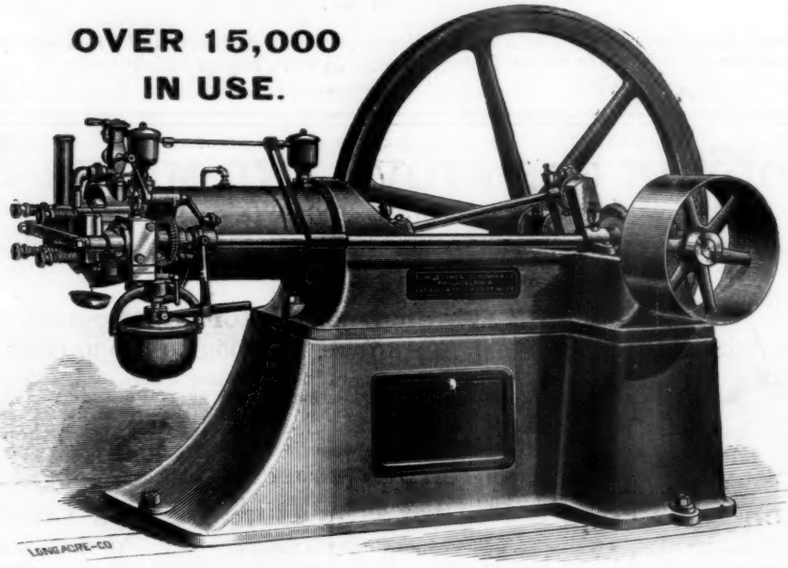
TWIN ENGINES Impulse every revolution.
THE STEADIEST RUNNING GAS ENGINE YET MADE.

ENGINES AND PUMPS COMBINED,

For Hydraulic Elevators, Town Water Supply, or Railway Service.

Special Engines for Electric Light Work.

OVER 15,000 IN USE.



The Otto Gas Engine is now consuming, at a moderate computation, 2000 millions cubic feet of gas per year, nearly all of which is furnished during day time only.

THE ONLY HIGHEST AWARD, ONLY GOLD MEDAL,

AT ELECTRICAL EXHIBITION, PARIS, 1881.

MADE IN SIZES FROM 1 TO 25 HP. INDICATED.

FOR PARTICULARS, PRICES, ETC., APPLY TO

SCHLEICHER, SCHUMM & CO.,

Works:
N. E. Cor. 33d & Walnut Sts., Phila., Pa.

Branch Office:
214 Randolph Street, Chicago, Ill.